MANAGING THE SCIENCE CURRICULUM

A concise report on a year professional development
Submitted for the post-graduate diploma
in Applied Educational Studies

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September 1990

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Keshar M. Tamrakar

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ABSTRACT

This report is concerned with the activities carried out by a science/chemistry teacher of Budhanilkantha school, Nepal in order to acquire knowledge of the British educational system and to explore new approaches to teaching and learning in schools.

Chapter one is an introduction to the study in which my own history, the objectives of the study and a summary of activities carried out are reported. A picture of science education in Nepal is presented in the Chapter two.

To achieve the standard of education in the school, management is one of major tasks to be done by the concerned head of department. The effectiveness of a department is influenced by the management and the curriculum offered. It depends upon co-operation among departmental members and the activities and experience of the teachers within the department. In chapter three particular attention is paid to the the role of the head of department and schemes of work in running the science department effectively and in delivering the curriculum.

Chapter four outlines the method of enquiry for the school visits and Chapter five provides an account of the school visits in which the structure of science departments, the schemes of work used and the support provided to inexperienced teachers were investigated. Budhanilkantha school is an English-medium school and it enters students for the Cambridge Overseas Examination and so the concluding chapter considers the outcomes of the visits and their implication for my work and my school.

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CHAPTER I

INTRODUCTION OF THE STUDY

1.1 Introduction

My first job was with an auto workshop, Balaju Auto works at Kathmandu. I joined the company after completing a three year diploma course in General Mechanics in 1974. At that time, I had little idea of what I really wanted to do for a career. I spent one year in the company as a senior machine operator. In 1974, after leaving the mechanical job, I started further education to establish a new career in science. In 1983, after completing a Master's degree in organic chemistry from Tribhuvan University, Kathmandu, I started a new job in teaching as an assistant lecturer. I was posted to the Institute of Engineering, Western Region Campus at Pokhara (western part of Nepal) to teach Chemistry as well as Mechanical Technology for (Civil, Mechanical and Electrical) trade and certificate level students. The institute was newly established in the western part of Nepal to promote engineering education, particularly for local young boys and girls who, having scored high marks in the school leaving certificate examination, are aiming for certificate level engineering. The institute also catered for trade level training for those who had only completed class VII. At the mid-point of my duty at Pokhara, I was offered a chance to undertake advanced technical teacher training at Hawthorn Institute of Education in Melbourne, Australia for 15 months. After gaining a lot of knowledge on

technical training, I went to Pokhara to teach new technology. Pokhara is situated 200 Kilometres west of Kathmandu, nestled in a valley beneath the Annapurna massif. Pokhara has won the hearts of travellers from around the world. Many visitors find their most lasting impression of Nepal comes not from the Kathmandu valley's Durbar squares, but from the awesome fish tail of Magnificent Machhapuchhare reflected in the still waters of Pokhara's Phewa lake. After three years, I decided to look for a teaching job at Kathmandu. The advertisement for a position of chemistry teacher at Budhanilkantha school was ideal since experienced and dynamic young postgraduates were specifically encouraged to apply. I applied for the position and as a result was offered the post as a chemistry teacher to teach science and chemistry for junior to A-level students. My duty was not only to teach the subjects but also to be involved in different activities and look after one house as a member of pastoral team. The school is a boarding school and so students only return home during long holidays.

1.2 Budhanilkantha school

Budhanilkantha school is the only one of its kind in Nepal where both rich and poor students from the Mechi to Mahakali (Nepal is divided into 14 zones, Mechi and Mahakali are two zones which lie in far western and far eastern parts of the country) study and live together and it is meant to take the form a comprehensive school. Boys normally enter the school in February after their ninth birthday and most stay at Budhanilkantha for seven years. The school was established in 1970 with the collaboration of the British

Government and is situated 8 kilometres north of Kathmandu city centre. Budhanilkantha is a place for worshippers of the god Vishnu. There is a statue of Vishnu lying on a bed of snakes displayed in the centre of the squares's pool inside the sanctuary. The school lies just 5 minutes walk from the sanctuary and is located in a very peaceful and pleasant area on the slopes of a mountain. The school has the policy that each of the 75 districts of Nepal should be represented by one or more students and among them nearly 10 percent are awarded scholarships.

Budhanilkantha is proud of its not so long history and of its academic and sporting traditions. The school's principal aim is to provide a continuity of education enabling pupils to acquire the necessary qualifications for entry to university, other higher education or the careers which they wish to follow. The school's academic standards are high, and the organisation of work and pastoral care encourages boys to achieve the best results. In addition to the high standard of academic achievement, the school introduces all of pupils to a wide range of sporting, cultural and creative activities, and encourages full participation in them.

The school has 587 boys studying from class IV to A2 level. At present, the A level is limited to science subjects. There are 53 teaching staff in all. Eight are British teachers including a headmaster among them.

Seven years ago, His Majesty's Government of Nepal, by a cabinet decision, directed that Budhanilkantha school should be re-designated as the National school of Nepal, and that English should be initiated as the medium of instruction, with the aim of working towards the General Certificate Examination of the University of Cambridge Local Examination Syndicate at ordinary and

advanced level (GCE-O and A-level), However the Nepalese teachers are not so acquainted with the Cambridge syllabus and teaching methods, and according to the agreement between the British and Nepalese Governments, the school is supposed to be handed over to the Nepalese Government alone or to move into the private sector. Considering these two factors, Nepalese teachers who are unfamiliar with the British education system are sent to the United Kingdom to study education under the British Council, Technical Co-operation Training Department, with a view to them being better prepared to teach the courses offered by the school. For 1989-90, three teachers were nominated from the school for higher education/training in the U.K. I am one of those teachers.

1.3. Objectives of the study

The main purpose of the study was to become familiar with the British educational system, new teaching technologies in science education and modern equipment, and to explore new approaches to teaching and learning in my school. Apart from this objective, I hoped to improve my proficiency in English language, and aspects of chemical education which could be implemented back in my school. Thus more specifically the objectives which I hoped to fulfil are as follows :

(a) become familiar with the educational system of Britain

(b) become familiar the methods of teaching in A-level chemistry

(c) enquire into the management of curriculum within science departments

(d) produce guidelines for teaching schemes for A-level chemistry students in my school

(e) improve my knowledge and understanding of chemistry

(f) improve my written and spoken English

(g) develop skills for research work on education

(h) become familiar with computers

1.4 Activities undertaken

The following is a summary of the activities undertaken at different periods throughout the academic year 1989-1990 and an indication of which objective each activity contributed to:

Activities	Objectives to contributed to
1. School visits : Eight schools within York and outside of York	a,b,c,d,e,g
2. Attending English language courses	f
3. Knowledge on education seminar : attending staff-graduate seminar on education - once a week, attending MA in educational studies seminars - once a week	a,b,c,f,g
4. A - level chemistry revision : attending some undergraduate courses in the chemistry department	e
5. Up-dating A - level chemistry practical : performing chemistry practical, using the Nuffield	b,e

	Chemistry Course, in the science education department (appendix A)	
6.	Computer work : at first word processing on BBC computer in Science Education Department, later introduction to Vax in the Computer Centre	h
7.	Supported self-study : relevant books from library	a,b,c,d,e,f,h
8.	Association for Science Education (ASE) meeting : 3rd - 6th January held at Lancaster University	a,b,c,g
9.	Course on Managing the Science National Curriculum : 12th - 16th February held at York University	a,b,c,d
10.	Course on Chemistry, Industry and Environment : 2nd - 6th April held at York University	a,b,d,e
11.	British Association for the Advancement of Science (BAAS) meeting : 21st - 24th August held at Swansea, Wales.	a,b,c,g

CHAPTER II

SCIENCE EDUCATION IN NEPAL

2.1. A short introduction of Nepal

Nepal is a completely land-locked country, boarded on the North by the Tibetan autonomous region of the people's republic of China, and by India on the other three sides. The country can be geographically divided into three longitudinal belts. The Himalayans to the North, the middle hills, and the Tarai, or flatland to the south. The variations in altitude range from the peak of Mt. Everest, the world's highest mountain at 8848 metre to the lowest point in the Tarai (flatland) which is just a few hundred feet above sea level.

The kingdom of Nepal covers an area of 56,827 sq. metre which corresponds to roughly to England and Wales combined. The weather varies according to the altitude but all parts of the country experience the mansoon which lasts from about mid June to late August each year.

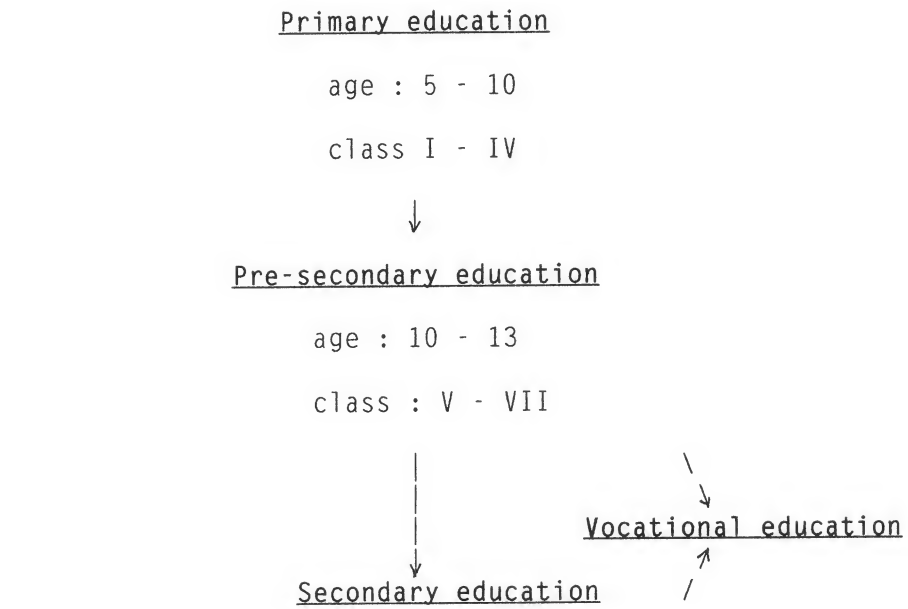
The population of Nepal is now between 18 and 19 million and it is technically very diverse. There are approximately seventy five different ethnic groups and sub-groups and no fewer than 36 different languages and dialects are spoken in Nepal. Nepali has been designated as the national language. About 90 percent of the population is Hindu, the remaining 10 percent is comprised mainly of Buddhists and Muslims. The country is divided into 5 development regions, which consists of 14 zones and 75 districts.

Nepal is ruled by hereditary kings and the Panchayat system of democratic government (since 1959, introduced by present the king's father) accords King Birendra Bir Bikram Shah Dev full power as the head of state. In a complete surrender to opposition forces demanding an end to Nepal's feudal style executive monarchy, the King recently announced the lifting of a 30 year old ban on political parties and also promised to amend the Nepalese constitution to pave the way for the introduction of Western style multiparty democracy.

2.2 Education system in Nepal

Nepal is one of the developing countries in the world due to the lack of education and resources. The development of the country is dependent on the inter-relationship of education and economic conditions. Illiteracy is still estimated at approximately 60 percent for men and 85 percent for women. The figures are however misleading in so far as they include all those adults who, when they were of the age to go to school, they had none go to , particularly in the rural areas. During the 104 years of the Rana regime (1846-1950), Nepal remained a closed country, into which no external influence was allowed to penetrate. There were no education facilities for the children of the general public. At the time of the fall of Rana regime in 1951, there were 203 primary schools, 200 middle schools, 11 secondary schools and two colleges that were affiliated to one of the Indian universities. Only 2 percent of the total population were reported to be literate and less than one percent of the school age children were admitted into schools.

Within three years, by 1954, Nepal was reported to have 921 primary schools, 316 middle schools, 83 high schools and 21 colleges. The number of students had also increased from a total of 10,900 in 1951 to 73,607 in 1954. These figures show that after the fall of the Rana regime there were considerable advancements in educational provision in Nepal. It was only after 1951 that consistent steps were taken to provide schooling facilities to all. According to the 1985 statistics, there are 16,772 schools in the country in which approximately 2 million students are enrolled. These are mostly focused around Kathmandu and other developed areas. Figure 1 shows the main features of the different phases of the educational system.



Educational System in Nepal

Figure 1

Primary education is compulsory in theory but it is difficult to implement due to the lack of roads, communications and of course the economic conditions of the families. Young girls must take care of their baby brothers in the fields or pastures. Primary schooling was made free in 1975. Text books and reading materials were provided free to the children of remote areas and those with handicaps.

Secondary education is not free, but the Government is studying the possibility of granting free access to secondary school, in the first instance to families that have no more than two children.

In theory, education is compulsory for young children, but there are no binding rules which require people to send their sons or daughters to school at a particular age. These days, most of parents are conscious of education. As a result of this, they send their children to school at the age of 4, although this is likely to be in urban areas rather than rural areas. Since 1980, the number of nursery schools and kindergartens has increased remarkably in the developed areas in Nepal, particularly in Kathmandu. At the age of 5 or 6, the child is admitted to class one. Normally, successful students spend ten years in school and at the end of the schooling, they have to take a nation-wide school leaving certificate (SLC) examination, in which seven papers are examined including English, Mathematics, Science, Nepali as compulsory subjects and others are optional subjects such as Optional Mathematics, History, Geography, Vocational subjects etc. English is compulsory and taught from the primary stage to the higher levels in campuses. After successful completion of S.L.C. examination, students are qualified for higher education. Less than 35 percent of candidates taking the examination get entrance to campuses to study intermediate level in different

subjects for 2 years. The most popular fields of higher studies are Science, Management, Public Administration, Business and Economics and to lesser degree Law, Humanities and Sanskrit. Vocational education and training is also one of the top priorities in the Institute of Medicine, Engineering, Agronomy, Forestry etc. For Science, Engineering and Medicine, preference is given to those students who have high scores in the S.L.C. examination. At present, there is no entrance examination, however admission is given according to the merit basis of S.L.C. examination, in which scores are calculated from the marks for English, Science, Mathematics and the average score of S.L.C. examination. To pursue technical studies, facilities are generally offered in the form of scholarships in India, the U.K., the U.S.A. and other countries. In Nepal, the number of years spent on campus by a successful student is normally 6 years plus, at the end of the course, they have to spend three months in one of the districts of Nepal under the National Development Service Programme. In Nepal, there was only one university, Tribhuvan University, until 1986 and the University controlled all the campuses throughout Nepal. Now a new university, Mahendra University, has been set up for restoration and popularisation of the ancient language of the Aryan people, Sanskrit. Under the university, more than 1000 students are studying higher level in Sanskrit on three campuses.

Although, the teaching medium is in Nepali language in the Government schools and campuses, it is done in English in some English medium boarding schools and campuses (where Science and Technical subjects are being taught) as there are insufficient text books (Science and Technical) written in the Nepali language.

There is no part-time study as in Great Britain, however, students

may take examinations as private students. This only applies to higher education and does not include Science, Medicine and Engineering subjects.

Teacher training is not essential to become a teacher in schools or campuses. Nevertheless, most of teachers are aware that to have teacher training, or courses on education, will improve the quality of their teaching. Teachers are encouraged to do education courses or training while teaching.

In the government schools, teachers and students have only a small range of aids to assist the process of teaching and learning, however, a teaching materials centre produces a wide range of teaching materials.

Computer assisted learning is a new and rarely used teaching approach in schools.

Most of the independent schools have audio-visual equipment such as slide projectors, overhead projectors, video etc. but the quality of the teaching materials for this equipment is not so good.

2.3 Science education in the school

The science department is an advanced, modern and well equipped department in Budhanilkantha school. It is one of the main departments in the school, because the school spends a large proportion of its budget on the development of the science department and science education for the boys by providing modern equipment to do practical work.

The department is housed in 7 laboratories : 3 dedicated to teaching class 4 to 10, each specialist for the O and A level sciences and

one computer room for teaching computing. There is a high level of resources and equipment available for work, which has a heavy practical bias. Virtually every science lesson is taught in a laboratory. The department provides a high standard of science education to 587 boys of ages 9 - 18.

The aim of the department is to make education in science a practical experience that students enjoy. In acquiring scientific skills, techniques and ideas students equip themselves with knowledge which is essential in this rapidly changing modern world.

2.4 Organisation in the science department

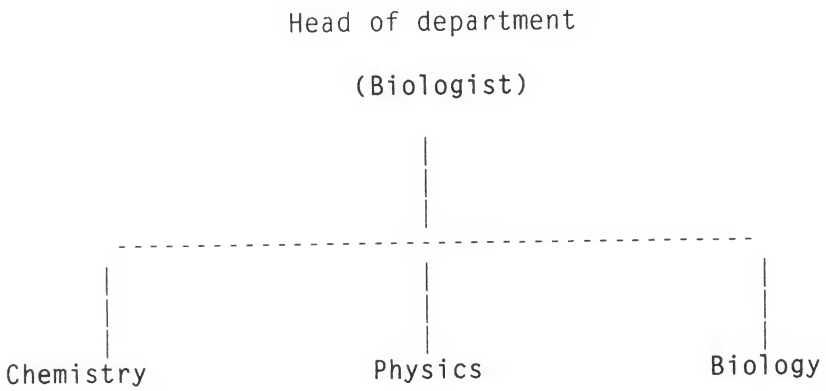
At present, there are twelve science teaching staff. Among them are two British teachers and a Dutch part-time teacher and they are assisted by three laboratory technicians working from the three preparation rooms. The department is led by a head of department, who is a Biologist. To co-ordinate the work of twelve teaching staff and three laboratory technicians at Budhanilkantha involves a great deal of team work :

- holding a weekly meeting on Thursday for one hour to plan, discuss and evaluate
- working to common conventions in class room and laboratory management and in the standards expected in pupils' work
- writing a one page report on each individual student to their parents two times a year
- organising field trips, science exhibition, quiz contests, debates on current scientific issues etc.

Organisational chart of science department

Academic Year

1989-1990



Chemistry	Physics	Biology
* Senior chemist	* Senior physicist	* Senior biologist
* Chemist	* Senior physicist	* Senior biologist
* Chemist	* Physicist	* Biologist
* Chemist		* Biologist
* Lab technician	* Lab technician	* Lab technician

Everyone in the team has a major part to play in making the department run effectively. The head of department has a key role, providing the leadership and being responsible for ensuring that a broad view is taken without undue emphasis on any one particular component or subject. In addition, he must ensure that the day to day running of the department is as smooth as possible. A head of science usually has a teaching role similar to that of his colleagues. Staff generally teach between 20-25 periods per week out of 35 in the science department and for the rest of the time, they spend in evaluating homework, preparation for practical work and teaching materials and working on lunch duty and tiffin duty.

2.5 Academic and pastoral care

As always, academic progress is regularly monitored, and this is ensured by a system of monthly assessments, half yearly examinations, interim reports, yearly examinations and staff discussions. These assessments and reports are studied by group tutors, housemasters, the headmaster and finally parents. A full report is made on each student at the end of each term by the teacher concerned, housemaster and headmaster in a separate report writing pad. The department believes successful science education arises from a combination of dedicated staff, motivated pupils and interested parents. The department encourages parents to take an active concern in their son's work and progress. Parents are also invited to know their son's academic performance in science and other subjects directly through the teacher concerned once a year at the mid-point of the 2nd term. This is a very important part of the induction programme. If parents wish to contact staff on matters concerning their son's progress in science, the department always welcomes them to talk about him with the teacher concerned or the head of department at any prearranged time.

The department considers care for the individual is the key to pupils' high rate of success. Each boy is a member of one of the seven houses. Housemasters, under the general guidance of the headmaster are responsible for their pupils' academic supervision and pastoral care. There is at least one science teacher in each house as a pastoral team member and he is assigned to carefully look after academic progress of a group of students consisting of 12-15 boys. Apart from this, the teacher has to assist all students of a house, if they need help on a topic concerned with science. It is

done on the duty day of the teacher which occurs once per week. For academic purposes, the school is divided into 7 classes from 4 to 10 plus 3 levels O to A2. Boys normally spend one year in each class or level moving up in February.

2.6 A-level and higher education

In 1984, the O-level courses were introduced in the school. These were followed by A-levels. So far, the A level is limited to science subjects in the school. After successful completion of the O level examination at the age of 16 or 17, a selection team for A level selects qualified boys to continue for A level in the school. The selection is done according to merit basis and their interest in A level study and a few places are kept for the boys from outside the school, selected after trial examinations and an interview by the headmaster and science teachers. The students choose either Chemistry, Mathematics and Biology as a Biological science students or Chemistry, Mathematics and Physics as Physical science students. Of the 35 A-level Budhanilkantha graduates from the last two years, between 32-34 are now studying abroad. Currently 15 top students from this group are studying science related subjects in the United Kingdom and will continue to do so from the beginning of the forthcoming academic year under various scholarships.

2.7 A-level graduates and their places

The current university and higher education status of boys who took

the A-level examination of the Cambridge International Examination Board in 1987 and 1988 in the school is as follows

Year : 1987 November

Number of students appeared in the examination : 21

Pass rate : 95 %

Results

Cumulative grade frequencies in all subjects at A-level

Grade	A	A-B	A-C	A-D	A-E
Budhanilkantha (November 1987)	13%	40%	70%	87%	97%
U.K. (June 1987)	17%	33%	48%	63%	76%

Year : 1988 November

Number of students appeared in the examination : 14

Pass rate : 100 %

Cumulative frequencies in all subjects at A-level

Grade	A	A-B	A-C	A-D	A-E
Budhanilkantha (November 1988)	29%	60%	74%	93%	100%

With reference to these figures, it is perhaps not surprising that demand for places on the A-level course is also very high. Many parents are anxious to enrol their sons in the school, because they are fascinated by the school's academic excellence and by the number of boys who have won scholarships to foreign universities to undertake the study of science related subjects (appendix B).

2.8 Science department and curriculum

The science department at Budhanilkantha provides about 184 periods of teaching per week, making science by far the largest curriculum area (appendix C). Teaching group sizes average 25-30 pupils per class up to O-level whereas in A-level it is 14-20. Most science classes taught in double period blocks of 80 minutes. Science is compulsory in the school. Most of science courses for classes 4 to 10 in the school are integrated science. According to the text book policy of the department, each and every student is provided with a prescribed text book. For class 4 and 5 ' Science Today' is followed and class 6 and 7 'Science 2000'. There are no text books for class 8, however, cyclostyled binded separate science books are supplied. These were produced by the school science teachers to make a bridge to class 9. The department follows two prescribed text books for class 9 and 10 published by Janak Educational Material Centre, Kathmandu in order to meet the National Curriculum. The book consists of different branches of science like Geology, Biology, Astronomy, Chemistry, Industrial Science, Physics, Food Sciences etc. Students of Budhanilkantha must sit the Nation-wide school leaving certificate examination (SLC) at the end of class 10 in January. 50 percent of the class 10 students join GCE O-level courses in the school. After completion of the O-level, again 50 percent of the students continue with A-level in the school. The syllabus for O and A level is that provided by the University of Cambridge Local Examination Syndicate (UCLES). The overseas examinations are set and marked by the Board. In the school, the teaching medium as well as written medium for all the age groups is English except where the Nepali subject is being studied.

According to the policy of the school, the students are set by ability. From class 4 to 10, each class is divided into three sets A, B and C in which the most able students are placed in set A and least able students in set C. The setting, based on their examination performances, is revised twice each year.

There is no setting for the O and A level students in this manner. At present, there are two groups in O-level, and A-level sciences are flourishing with two sets of the A1 and A2 taking Chemistry, Biology and Physics. The school has had outstanding results in recent years and is looking towards an increasingly student centred approach at this level.

2.9 Science activities within the department

The science department has an itinerary to organise various activities in order to encourage the boys in the field of science. Boys are involved in the following activities each year.

a. Science clubs
   - i Natural science club
   - ii Chemistry club
   - iii Physics club
   - iv Computer club

b. Science quiz

c. Debate on current science issues

d. Visits : Industry, National Computer Centre and Zoo

e. Open day : Science exhibition in the school science laboratories

f. Science field trips

g. Essay competition

h. World environment day

i. Participating in school-wide science exhibition and quiz contest

The Science Club meets every three or four weeks on Tuesday evening for about one hour. It is supported by presentations from various related disciplines to the members of the club. The club meetings have remained informative, educational and enjoyable and have fascinated students from class 8 upwards. If there is no speaker, students have a science film or documentary. This meeting, to which the head of department contributes as co-ordinator, aims to up-grade and update students' knowledge and understanding of science and technology. In addition to the Science Club, the department is expected to run at least one club in science by a teacher after school lessons. At present there are five clubs running under the following headings : Chemistry, Physics, Natural Biology, Computers and Photography, in which pupils of class 8 upwards have a chance to be members and to promote their knowledge in specific areas of science after lessons. The clubs run once a week for one hour. During this period, the members of the club perform various experiments and small project work under the guidance of a co-ordinator.

2.9.1 Open day and science department

The school's open day is an important day for the science student because they welcome their parents and other friendly visitors and take the opportunity of showing them what happens in the science

department at Budhanilkantha. In the science block visitors will be able to have a look at the scientific life of the school. Equipment and demonstrations are set up in the Chemistry, Physics, Biology and Computer laboratories, showing the enormous amount of apparatus available for use. Some of the exhibits and science posters prepared by the students were self-explanatory, but other demonstrations give an opportunity for the boys to show their understanding of their subjects and equipment. It is clear that the science department places equal emphasis on theory and practice.

The RONAST science exhibition is organised each year by the Royal Nepal Science and Technology. Every year the students of Budhanilkantha have participated in the exhibition under the guidance of a science teacher and the demonstrations have resulted in the winning of at least one top prize each year.

As a result of being the best in the RONAST science exhibition 1987, one class 10 boy from the school had an opportunity to participate in the eleventh Singapore youth science fortnight in 1988. This event aims for students to widen their scientific knowledge and understanding. Participating in such a scientific gathering is likely to cultivate their scientific imagination and creativity during this formative stage. There are no equivalent events in Nepal.

2.9.2 Conservation Week

The school has already started to celebrate Conservation Week in the 1st week of April each year. The aim of the week is to become familiar with the conservation message and to get everyone thinking

about ways in which we can help to protect our environment. The school had been involved for some years with tree planting and land erosion prevention schemes, together with treks and expeditions to many parts of Nepal. During the week, the school's entrance hall, science foyer and Biology laboratory were decorated with some of the hundreds of entries for the poster, poetry, artwork and debating competition on the theme of conservation. Throughout the week a series of videos and films on wildlife and the environment are shown.

Each year Tiger Tops PLS offers scholarships to the students. Eight boys and one member of staff are invited to stay at Tiger Tops for two nights and to participate in a full programme of activities related to wildlife and the boys have to write an essay about wildlife and tourism.

The department organises from time to time these types of activities, because the department's aim is to offer an exciting programme in different areas of science.

2.10 Policy of the Science Department

The department has set up policies in order to maintain the standards of teaching within the department and to increase the variety of activities for the boys.

The written work done by students in exercise books or tests should be read, marked and corrected at regular intervals. A weekly pattern is ideal. This should be done in addition to the assessment of certain practical, oral or written work.

The aim of this exercise is to motivate students, confirm that

misconceptions so that they can be remedied. Most of the comments given are positive and encouraging.

Staff keep a record of pupil attendance, by taking a register each lesson or noting absentees. Each teacher keeps a record of when exercise books are marked or when assessments are made. The teacher's record file includes the date and mark or grade for each piece of work. It is the department's policy to issue text books to students and to encourage students to use and borrow reference books from the library. Each and every student must have a text book prescribed and supplied by the department.

The department encourages the use of the BBC computer by students in class 8 and above. Staff are also encouraged to use this facility to prepare question papers, reports, hand-outs etc.

It is the duty of all staff teaching in the science department to be aware of health and safety at work. Cleaners and laboratory technicians have the responsibility to keep the laboratories clean and tidy.

A complete check on the services in the laboratories is done each holiday. Any fault is listed with a copy for head of department to take further action for maintenance of the department.

As a whole, science education in Budhanilkantha is greatly influenced by the British Education system in that it provides the maximum practical bias in order to acquire scientific skills, techniques and the required knowledge.

CHAPTER III

MANAGING THE SCIENCE CURRICULUM

Management is a never ending process through which members of an organisation aim to co-ordinate their activities and use their resources for fulfilling the various tasks of the organisation as effectively as possible. In a science department, the role of head of department is to manage the science department effectively through various management activities in order to meet the required standards for science education in the school.

3.1 The role of the head of department

In the field of education, a head of department means a member of a school whose position in the formal school hierarchy lies in between the top policy making group (headteacher, deputy headteachers and board of governors) and more junior classroom teachers. The head of department's role involves both administrative and professional managerial responsibilities.

The head of department will have to perform the usual responsibilities for administering the affairs of the department such as assigning duties to the members of the department, preparing the departmental daily routine, preparing the budget for the department and requisitioning supplies, recommending new staff members, promoting existing members of the department and

recommending permanent status for temporary teachers etc. In the more managerial aspects of the work, the head of department is supposed to lead the teachers and help them to improve professionally and should be able to demonstrate specialist knowledge in the area of teaching methods.

Hull and Adams (1981) identified the following aspects of the role of head of department :

(a) communication

(b) departmental staff meeting

(c) decision making

(d) delegation of responsibility

(e) staffing

(f) organisation of accommodation, apparatus and materials and technical assistance

(g) finance

(f) the department's curriculum policy

Clearly, delegation of responsibilities will contribute to the professional development of members of the department and as such is a more managerial aspect of the role of the head of department.

It is a good idea to have a member of department who is clearly in-charge of each course in the science curriculum and the head of department should be overall in-charge of the preparation of schemes of work or providing guidelines for their preparation. In particular, I found this type of role in the head of science department of School D (see chapter V).

In a school, the head of department is responsible for the work of all the teachers in the department and all the classes, which he or she has delegated to them. John (1980) pointed out that the task of a head of department is to co-ordinate all the elements which

contribute to the class and which relate the whole of the environment of the department.

The following are the elements contributing to a class :

(a) the teachers

(b) the students

(c) the time available

(d) the space in which the work is performed

(e) the ideas (consisting of facts, concepts, skills, attitudes which are to be taught to the students and the ways by which they can most effectively learn them)

(f) the materials acquired or prepared which are to be the basis of the pupil's work

With reference to all of these elements, the head of department's task is to select, acquire and make them accessible through different activities of management.

The head of department must clearly understand that for the effective running of a department, there must be sufficient ways or channels for the communication of information, instruction, ideas, opinions etc. whether in its day to day routine or in the planning and implementation of change. It is most essential to set up a net work of two way communication between all members of the department. It enables the best use to be made of all available expertise and experience in solving the problems of the department. It can be done either in formal staff meetings or informally during unstructured encounters such as chats in the main staff room or in the preparation room at break or lunch time. Informal communications are more effective in satisfying the needs of individuals and in achieving gradual shift in attitude before major changes.

The head of department has to play a key role as a chairperson in the departmental staff meeting and very often it should be held and conducted in such a way that staff contribute to effective communication in the department. It enables staff members to participate in order to make appropriate departmental decisions. In the meeting, the head of department must ensure that he or she conducts the important task of gate keeping which makes sure everyone has a chance to take part and contribute to running the department effectively. For departmental decisions, the ultimate responsibility rests with the head of department or it can be shared by the head of the separate science subjects. The head of subject may in turn delegate responsibility for specific courses to individuals. It makes it easier for the head of department or head of subject if the responsibility for some of the less important decisions is delegated. This also enables inexperienced teachers to exercise their judgement, encouraging them to become involved in the running of the department, and allowing them to acquire experience which will be useful in their future careers.

In some schools, the head of department also has additional responsibilities for some supervision and for dealing with disciplinary cases. For example, the head of science department of Budhanilkantha has delegated to him an extra responsibility for administering affairs of the school as a administrative head as well. In addition to fostering the science department team, he has to arrange transportation for various activities and publish notices concerning student activities.

A head of department has to play a key role as a leader in a department. In order to provide effective leadership, a head of department must have clearly defined responsibilities and in

exercising these responsibilities, he or she should vary the management styles to suit the circumstances. Thus in making routine decisions to facilitate the work of department members he or she ought to decide with little consultation, but in the area of more significant policy decisions the commitment of all staff is needed and he or she ought to be more consultative or democratic.

The main aim of the head of department should be to foster the team to develop a complementary unity and diversity. Of course, it is a challenging task, in which the head of department must help both teachers and students to give of their best in performance.

The success of a department in a school depends upon the members of the department and the head of the department understanding their respective jobs.

3.2 Schemes of work

Educationalist have put forward different views on schemes of work and the policies adopted in schools vary. Teachers prepare their own scheme of work to suit the nature of the school and its policies. Hence a scheme of work can be defined as a written document, prepared by a group of teachers of a school which describes the work planned for students within a class or group over a fixed period. Department of Education and Science (1989) suggested in the National Curriculum, Non-Statutory Guidance, that it is an essential element of the school's documentation policy and it reflects whole school approaches to teaching and learning and the national curriculum which describes the science entitlement for students. Most departments organise work in areas of study which could relate to

the content of subjects : Physics, Biology, Chemistry, Astronomy, Geology or alternatively to particular approaches : projects, models, processes; additionally areas of study can be taught through a variety of organisational patterns. Clearly it is useful to divide the area of study into smaller units, for example, topics, themes and even lessons.

3.2.1 Purposes of scheme of work

Combining the proposal from Hull and Adams (1981) and Department of Education and Science (1989) in the Non-Statutory Guidance, it is clear that the main purposes of the scheme of work are to :

- check the subject matter, the teaching techniques to be applied and the rate of progress in teaching
- communicate all aspects of the course to the teachers in an integrated form
- co-ordinate the course delivery
- ensure the completion of the course within the prescribed time
- support and provide a guidance for new teachers, student teachers and those teachers who are not familiar with the subject matter which has to be taught
- widen the experience of the teachers who are involved in teaching the course

In order to achieve these purposes through the scheme of work, the following points should be considered.

- the skills, ideas and attitudes which are expected to be developed as a result of the teaching in the course

- detailed information of what is going to be taught and the sequence of the topics to be studied and clear detail of how each topic is to be tackled
- different routes of teaching the topic, from which the suitable one is selected in order to suit the particular students
- an indication of the depth treatment
- brief notes on availability of apparatus and demonstration materials

Obviously, a scheme of work is viewed as a working document in the school. It affects thinking about the transference of the curriculum, but it is necessary to amend it frequently to take into account more effective teaching methods, approaches and current issues which will contribute to the greater relevance of the work.

3.2.2 Importance of the schemes of work

The scheme of work can play a significant role in improving the achievement of the aims and objectives of the course (curriculum). In addition it enables teachers to change the syllabus into a number of lessons and in so doing make use of their experience.

Some teachers may spend too long on those topics which are of most interest and are easier for them to teach. It is not fair to fail to complete the course within the period of time allocation or to complete it too early. In this case the scheme of work encourages teachers to keep up a reasonable pace and, as a result of this, by the end of the course all students will have reached a common point. It is most important to complete the course in the time available.

are available in the department and where it is placed. If there is good co-operation among the teachers, then they may help them but it not always possible, due to the lack of time or, they may not be available when needed. If there is a good scheme of work in which the availability of apparatus is indicated, then new teachers will appreciate the importance of the scheme of work.

An indication of an appropriate homework or task related to the subject matter being taught, will also help, particularly inexperienced teachers and other teachers who are unfamiliar with the subject matter. It makes sure that the homework is set regularly and it relieves the teachers of the burden of preparing homework tasks in each and every topic.

As indicated in the introduction to this report, a primary aim of my work was to enquire into the management of the curriculum within science departments. As argued above, schemes of work and their methods of production, review and development are central to this management role. It could be argued that the maximisation of the effectiveness of a department, within the constraints of the qualities of the teachers available and the physical resources, will largely depend on the schemes of work available. Thus, although the school visits described later in this report contribute to other objectives of my study, they were primarily aimed at researching the origins, nature and use of schemes of work in the schools.

CHAPTER IV

METHOD OF ENQUIRY

4.1 School visits

One of the major elements of my study programme involved a series of school visits. From the visits, a lot of information was collected for the purpose of the study, particularly in the field of science education. An enquiry can be done in different ways either from primary or secondary sources. The data or information already collected by others and made available in published form are secondary sources. For the purpose of research or the study of new aspects, primary information or data are indispensable. The procedures for obtaining primary data or information are mentioned in the literature under various methods. Three basic procedures are as follows :

(a) Correspondence

(b) Observation

(c) Interview

The procedures which I decided to choose for the enquiry were interview and observation while visiting the schools.

A personal letter or postal questionnaire can also be applied to collect information from the concerned person in the school, but the major disadvantage of this procedure is that further ambiguities might be introduced because of misinterpretation of the questions submitted and the answers given, incomplete return and the careless

completion of questions which are returned. Of course, it is not such a good procedure for collecting information from a small number of individuals, however it would be the best way, if it is needed to collect information from a large number of individuals at a relatively low cost and in a restricted period of time. In this procedure, it is not possible to talk face to face, whereas by visiting the school factual information can be collected asking face to face by means of observation and interview. Postal questionnaire procedure is just centred on the provided questions but if visiting and discussion is done, the researcher is able to extend the discussion in areas which emerge and prove interesting. The researcher will also be able to develop observational and collection of information skills. This is also an intention of the school visit rather than just using a postal questionnaire.

In this way, I was able to observe and discuss with the respondents and so obtain information which was as valid and reliable as possible. Misunderstandings about what I was asking were avoided, because it was a face to face situation in which certain confusions were immediately apparent and could be quickly corrected. The interview procedure also has provided an opportunity for the exchange of thoughts between myself and the respondent which cannot be obtained by solely observation and correspondence procedures.

4.2 Selection and organisation of the visits

Fundamental to the success of the school visits was the selection of the appropriate schools. The selection of schools for the purpose of the visit was done considering the nature of the school and its

suitability for my study.

The following factors influenced the selection of schools :

(a) Age range

(b) Day and boarding school

(c) Available of O and A level study

(d) Independent and state school

The respondent for the discussion was the head of science or chemistry of the school. It was accomplished with the help of my supervisor. First of all, the supervisor prepared a list of schools which were to be visited and made contact by telephone to the head of science/chemistry of the school to make sure when they would be available. On receipt of their agreement, the supervisor informed me to write a covering letter and a list of questions, in the form of an outline questionnaire which I hoped to cover in the discussion. The questionnaire and the covering letter were enclosed in a sealed envelope with the head of department's name and posted normally one week in advance, so that they could receive them in time to prepare for our discussion. In this way eight schools were selected and for visits organised.

4.3 Development of questionnaire and the letter

The arrangement and appearance of the questionnaire is of great importance in obtaining a good response. Considering this statement, a covering letter (appendix D) with a questionnaire (appendix E) were prepared.

For the development of the outline questionnaire, first of all I had to think in which field of interest was the discussion to be held.

The departmental organisation was chosen as the broad area of interest for the discussion. Departmental organisation is one of my topics of interest and it is one of the objectives of my study. Under the heading of departmental organisation five questions were developed, concentrating on two major aspects :

(a) Preparation, influence and review and revision of schemes of work

(b) Ways to support and encourage members of the department

The prepared questionnaire was of an unstructured type. These type of questions are suitable for individual discussion, but it may require the respondent to do some hard and reflective thinking. So a few extra blanks were provided under each question for writing discussion notes as a help to the respondent.

In the letter, these points were included :

(a) A brief statement of the purpose of the visit

(b) Interest in the field and titles for the discussion

(c) Name, address and the status of the person who is making the visit

(d) Exact day and date (after the agreement between the supervisor and the head of department)

(e) Request to obtain some small samples of their teaching schemes

The questionnaire and letter were typed and saved in the BBC computer in order to use in the future.

4.4 Selected schools

The selected schools were as follows :

Name of the school/college	Location	Nature
A	Near York	State school 11-18
B	Near York	State school 14-18
C	South of England	Independent college 13-18
D	York	State school 11-18
E	York	Independent school 13-18
F	York	State college 16-19
G	Scotland	Independent school 13-18
H	Scarborough	State school 11-16

On the agreed day and date, each visit was made to the selected schools with the following expectations :

(a) To acquire some information about the methods of producing schemes of work from syllabuses and the management of the science department

(b) To observe the science department

(c) To collect some samples of schemes of work

In most of the visits, the head of science departments were waiting to receive me at the entrance of the school. They easily recognised me as result of the posted letter and questionnaire. The discussion on the questionnaire was followed an informal introduction and the

formal discussion was undertaken in a room of the head of department for about half an hour to one hour concentrating on the provided questionnaire and some topics related to the teaching methods and pastoral care in the schools.

I found that the respondents were friendly, supportive and willing to provide the information I wanted and some samples of teaching schemes, as available. In addition to discussion, I had an opportunity to meet and talk with other science staff and to visit classrooms and laboratories for science practical lessons. While observing in the classroom and laboratories I was escorted by the respondent. As a whole, this type of school visit has been very fruitful for me in order to acquire knowledge on the educational system of the United Kingdom. Detailed reports of the visits are in chapter five.

CHAPTER V

ACCOUNTS OF SCHOOL VISITS

In total eight schools were visited within the United Kingdom during my study period. In this chapter, there is a brief description of each school visit. This is followed by a discussion of more general issues emerging from the separate visits.

5.1 School A

School A is situated on the edge of a northern metropolitan district. The school itself has a big complex with a play ground. It is said to be a biggest school in the area. At present, the school has 1500 students studying from year 11 to 18 and is a co-educational school. Each year, the school has enrolled 300 students in year 7 (age 11). The students are divided into ten groups. Hence, the class size is at this stage 30.

5.1.1 Science department

The science department is one of the major departments in the school. It is well equipped with a team of 16 teaching staff including a head of department and there are three helping staff called Lab. technicians. Teachers normally engage in teaching 35

lesson per week out of 40 lessons. According to the school time table, the first lesson starts at 8:25 and last lesson ends at 2:30. Each lesson lasts for 35 minutes. Science lessons consists of 2 double periods because one period is not enough to teach practical and theory. Laboratory technicians prepare all the required materials in the allocated classroom and, at the end of lesson, they clear up all the used materials and apparatus. All science teachers are accredited to teach science to ages 11 and 12 and specialised teachers teach separate Biology, Chemistry and Physics for ages 13 to 18 (appendix F).

5.1.2 Schemes of work and the activities within the department

The science department uses a variety of syllabuses and each syllabus has been broken down from large topics to small sub-topics and then into the single lessons. A single lesson from the syllabus consisted of both theoretical and practical aspects of the topic. It also included instructions to students for carrying out any experiments. This style of documentation is seen as very helpful for inexperienced and student teachers. One of the advantages of this detailed science scheme of work is to help new teachers to cope with the existing scheme of teaching of the school so that they might not have additional problem when dealing with students as a new teacher. On examining the schemes of work for the various science courses, although they were prepared by a different member of staff, they all reflect the department's common aims. Detailed lesson notes, worksheets, booklets containing extension exercise and the assessments were produced and then agreed upon by the rest of the

department. This is a brief analysis of one on ENERGY and HEAT. Energy and Heat is an unit of the lower school integrated science course (appendix N). In this unit, there are 19 core ideas and also mentioned are the thinking and practical skills developed through this unit. Before starting the unit, the prior experience required by the students in order to cope with the topic easily is quoted. e.g. 'Materials' topic, 'Variety of life' topic and 'Introduction to science' topic. The unit is divided into nine suggested teaching activities allowing a double period for each activity. Twenty two worksheets have been prepared for the unit using a code number for each worksheet. Each activity (dealing with forms of energy and energy changes) contains understanding, intellectual and practical skills. The knowledge and understanding section tells that students should be able to demonstrate knowledge with understanding in relation to

(a) Nine forms of energy

(b) Necessity of energy

(c) Usage of energy

The allocated time for each activity is one double period. After the completion of the activity, students should be able to record results in table form. Materials are listed which are required to demonstrate or to do the practical e.g. TV. and VCR., Exploring Science video "Energy" etc. Another heading is the detailed guide which explains about the sequence of teaching to the teacher. At the end of lesson, what kind of homework or extension activities have to be given to students is mentioned e.g. Draw a picture titles for the topic, worksheet LSISE 1 : energy in the life of Jane and David (appendix N). In this way the syllabus has been broken down from a large topic to small sub-topics and then into single lessons.

The following factors influenced the decision to prepare schemes of work.

(a) high turnover of staff

(b) high proportion of probationary colleagues

(c) should not invent the wheel 15 times in a year

Concerning the departmental support for less experienced teachers, the department provides existing teaching schemes, individual tutorials from an experienced teachers and discussions in the department. The department organises shredding sessions and discussions after the first run through for the revision and review of schemes of work. It is very important to construct the schemes of work in order to teach effectively in the classroom. The department members have been satisfied by the preparation of the teaching scheme in this way to meet the standards for science education at the school.

As a result of discussion with the head of department, the science teachers have been working very hard in order to improve the teaching schemes as well as using evenings to check student's home work so that they do not have freedom to extend the range of student activities after the lessons. However, they are thinking about it for future.

5.2 School B

School B, near York, has been in existence since before 1322. In 1909, it was established in what is now the old part of its present premises on Grammar Lane, and started a new life as a small mixed county grammar school. Since 1973, it has developed into a

comprehensive school of 950 students studying from ages of 14-18 and is a co-educational school. Pupils transfer at age 14 plus from, an 11-14 school a mile away. It has sufficient general classrooms and laboratories, arranged in subject areas and has new specialist suites for Commerce, Music, Home Economics, History, English, Mathematics, CPVE, Technology, Science as well as a sports hall, a large lecture theatre and a fine library/resource area, with a full-time librarian.

5.2.1 Structure of the science department and the schemes of work

The department is housed in 10 laboratories ; 4 dedicated to teaching Integrated science, 3 to Modular science and one each to the A level sciences. There is a high level of resources and equipment needed for the work which has a high level of practical bias. Every science lesson is taught in a laboratory. There are 10 full-time science teachers and three teachers who share their teaching with other departments; every member of the team is a well qualified specialists.

Head of the department (Chemist) 1

(a) Biologist 3

(b) Chemist 3

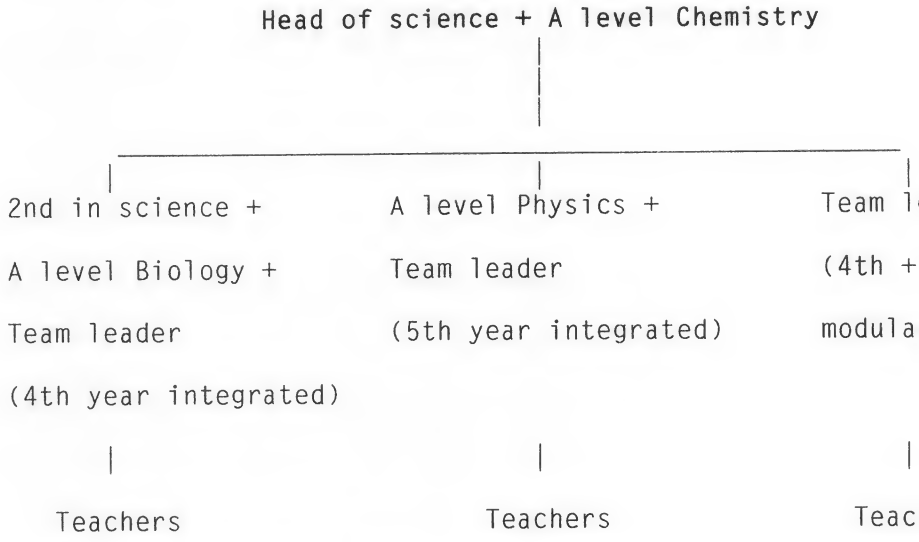
(c) Physicist 3

They have a senior laboratory technician, and two assistant technicians, all of whom are full-time during term. Several members of the department hold responsibilities in other areas. The department is forward looking and responsive to new ideas and challenges. They are well equipped to meet the demands of the

National Curriculum and look forward to developments in the 16-18 field. The department has a policy of offering A level teaching immediately to qualified new members of the team. Each science lesson lasts for 35 minutes. To co-ordinate the work of 10 teaching staff and three laboratory technicians at school B involves a great deal of team work.

- Weekly meeting to plan, discuss, evaluate, share ideas and demonstrate new experiments.

Everyone in the team has a major part to play in making the department run effectively. The head of department has to play a vital role, providing the leadership. There is a team leader for each year to co-ordinate the production of the scheme of work and each and every teacher takes part in the preparation of the schemes and progress reports on the students. The responsibilities can be represented in this way



The department has developed schemes of work which have been praised; a marked features of the development is the willingness of staff to share resources and experiences, which provides a very supportive frame work for teaching. The method used to produce a scheme of work is based on syllabus. The syllabus is divided into

topics according to age groups. The team leader of each year is a co-ordinator and each and every teacher takes part in the preparation of the teaching schemes. The method of preparation depends on the experience of the teachers and every year they have a meeting to review and revise the teaching schemes. For this, team leaders of each year have complete responsibility for the change. The department supports its less experienced teacher in these ways

(a) Providing packs of teaching schemes

(b) Aided by deputy head

(c) In-service training

The department has a history of effective in-service training and encourages attendance at high quality courses.

5.2.2 Courses taught

The science department has been a leader in the area in introducing balanced science courses for all students in the 14-16 age range (appendix G). The majority follow NEA : The Sciences Double Award GCSE, which is taught by a single teacher to a group in an integrated and progressive fashion. Approximately 30 percent of students follow NEA : science (Modular) Double GCSE which again is taught by a single teacher for each group. The courses are well established (running for their 5th year from September) and have led to very good GCSE results.

Thus, all 4th and 5th year science students following certification science courses will be taught either Modular science or Integrated science.

Modular science is a new and interesting course which gives students

a chance to learn about a wide range of science topics. Students will have the opportunity to show what they know and work with their teachers and the rest of the class to find out answers to questions which affect them. Each module of work is made up of series of lessons lasting 8-9 weeks in total. The module has a theme and the content of the lessons has been chosen to have relevance to everyday life. Students will complete 14 modules over the 2 years. Their titles show the great range of topics covered from Materials and their uses to Humans and Organisations from Energy to Colour.

The students have two teachers for modular science. Each of them will teach 3 lessons a week. Students have a separate book, are taught in different laboratories and study different modules with each teacher. It's like 2 subjects in one. At the end of each module students take a test which will see how well they know and understand the facts covered in it. Modular science is a double subject and they get double award at the end of the course.

Integrated science is the Northern Examining Association (NEA) science course and is new and exciting. It has many aims and is relevant to the real world. It is broad based and prepares students for study at a higher level in pure or applied science. There are six lessons per week. Students have two homeworks, one routine, the other more demanding. Students have three exercise books.

(a) Students own book for lesson to lesson use

(b) Patterns and record book for essential revision materials

(c) Assessment book for course work exercises

Assessment of their progress is varied and made over a very wide range of skills and abilities as well as of knowledge and understanding. 2/5ths of their final examination marks are gained from their course work and the final 3/5ths by end of course

examination.

A level sciences are flourishing, with two sets in each of the upper and lower sixths taking Biology, Chemistry and Physics. They have had outstanding results in recent years and are looking towards an increasingly student-centred approach at this level.

The science department is well managed and the policy of the department is well defined on different topics such as marking and assessment, record keeping, homework (4th and 5th year), text books (4th and 5th year), information technology, health and safety at work, laboratory care and other issues about teaching and learning styles.

5.3 College C

College C is the oldest boarding school for boys in Britain. It was founded in 1440 by King Henry VI for the worship of god, and for the training of young men to the service of church and state. Today, there are two chapels and all services follow the practice of the Church of England. There are four chaplains. Confirmation services are held twice a year in the college.

5.3.1 Students and college

There are now some 1270 boys at the college, comprising 70 King's scholars, or collegers, selected by competitive examination and about 1200 other boys, called oppidants, who normally qualify for admission by preliminary registration and subsequent success in

common entrance examination at the age of 13. The others (the 70 King's scholars who live in college) take the more testing scholarship examination. The oppidants are housed in twenty four boarding houses, each under the care of a housemaster and containing about fifty boys. Every boy has his own study bed room (although with parent's consent two new boys may occasionally share a room for not more than one half year). Boys normally enter the school in the September after their thirteenth birthday, and most stay at the college for five years.

5.3.2 Academic organisation and the curriculum

For academic purposes, the college is divided into five blocks (divisions), from F to B. Boys normally spend one year in each block, moving up in September.

On arrival in the college, a boy is assigned by his housemaster to a non-specialist tutor (or the housemaster himself may act as tutor). The tutor's principal function is to maintain a continuous supervision over his pupil's academic performance and intellectual development. To this end he will see them in a group of perhaps half a dozen. In F this group will meet once a week, when an essay or their written exercise will be discussed, In E and D the group will meet once or twice a week for private business (a unique feature of the college is the tutorial system), which is an opportunity for the tutor to engage the boys in some broadly cultural pursuit.

When the boys become specialists (in other words, enter the sixth form, and take A levels), they choose a specialist tutor. This will normally be a master who teaches what is likely to be the boy's

principal A level subject. His basic function is much the same as the non-specialist tutor's, but he may also act to a greater extent as adviser, on such matters as career and further education.

There are thirty five scheduled schools (i.e. lessons) a week in which formal teaching takes place, but almost all boys have one or more free periods. Boys are taught in Division (i.e. sets or forms) normally containing about ten or twelve boys in the case of specialist and about twenty in the case of non-specialists. When forming divisions, heads of departments take careful note of the boy's experience in and aptitude for the subject concerned.

In each block, a programme of regular out of school work is laid down. Division masters set this work well in advance of the due date, thus encouraging boys to plan their own free time in an effective and responsible manner.

Division masters keep housemasters and tutors informed of boys' progress by providing non specialists with order cards every few-weeks and specialists with interim reports in the middle of each half term. In addition, trials (internal examination) take place at the end of the Michaelmas and Summer halves, boys are examined in all their main subjects other than those in which they are being externally examined that half.

Of the 250 or so boys who leave each year, the vast majority go on to higher education, most of them to university, and a substantial number to Oxford and Cambridge.

5.3.3 Composition of science (chemistry) department

Science department is one of the largest departments in the college.

the department is divided into three separate sub-departments Biology, Chemistry and Physics. each sub-department has about 8 experienced masters. Most of them are doctorates.

The chemistry department is well equipped with a team of 8 chemists, including a head of department. There are three full-time and two pert-time helping staff called lab. technicians in the department, there are 8 big classroom cum laboratory rooms plus one big preparation room for lab technicians. Each and every master has a big classroom cum lab room where students come for study according to the routine. Masters do not need to change the classroom because they have got an individual classroom. In this year, there are 56 A level boys in 4 groups and 187 GCSE level boys in 10 groups studying chemistry. The science department has newly established a science library in a room of science department, where most of advanced level science books, latest science magazines and career prospect booklets of different universities are kept.

Each science lesson lasts for 40 minutes. the college does not make double lesson for science as other schools in Britain do. Double lesson only applies for A level students (appendix H).

5.3.4 Schemes of work in the department

Although the department realised that the teaching schemes help quite a lot to teach effectively in the class room, they do not have identical teaching schemes. However, some masters prepare teaching scheme for their own sake. The method used to produce teaching schemes is based on the syllabus. Syllabuses are broken down into workable teaching units. It is done by the masters concerned and

they use what they see as best practice. Most masters are well qualified and experienced. This is one reason not to prepare uniform teaching schemes. Hand-outs are very often used, prepared by the individual masters and also overhead projectors are used and increasingly videos. There is no departmental directive on the choosing the methods of presentation. Nevertheless to some extent advancing technology and the availability of better audio visual facilities influenced the masters in the presentation of their teaching schemes. The staff of the department very often discuss freely their teaching methods and review and revise their teaching schemes. The department would amend their approach in the light of comments which pass between them and tries to introduce as much practical work as possible in order to teach better. If there is a less experienced teacher appointed, advice is given on appointment in respect of matters such as discipline, dealing with inadequate work and related topics. Quite a lot of support exists in the form of departmental practicals, which are extensive. The department encourages its members to some extent but the range of student activities is restricted by the need to cover practical work for GCSE and this is main area of student participation at this and advanced level.

5.3.5 Masters and the college

In the college, masters as well as students must wear school dress and so be in uniform during the college time. The college has a tradition of all round school mastering and masters are expected to help with games or societies or the other multifarious activities of

the college. It has its own salary scale and accommodates married masters in college houses or flats and bachelors in flats or in colonies shared with three or four others. All appointments are probationary for the first two years. There are about 135 masters in all.

The college is an exciting place in which to teach, masters work hard and it is not a school for those who like a nine to five existence. It has room for individuality, however, and can use the services both of those who would like to move on after a few years and those who hope to make a career within the college.

5.4 School D

School D is a comprehensive situated in York. The school itself has a big complex with a big play ground. The school provides education to nearly 1000 boys and girls between the ages of 11-18. The ratio of boys and girls is nearly 1:1.

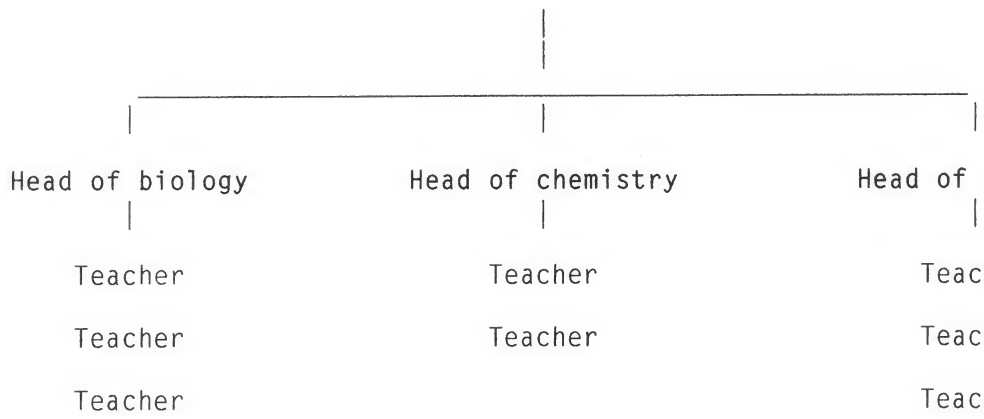
5.4.1 Structure of science department

The science department is one of the largest departments in the school. There are altogether twelve science teaching staff including a head of science and three lab technicians, one of whom works part-time. To co-ordinate the work of twelve teaching staff and three lab technicians at the school involves a great deal of team work.

- Formal monthly meeting to plan, discuss and evaluate

- Working to common conventions in classroom and laboratory management and in the standards expected in pupil's work.

Head of department/Head of physics



* 2 full-time lab. technicians

* 1 part-time lab. technician

Everyone in the team has a major part to play in making the department run effectively. The head of science department (head of physics) has a key role, providing the leadership and being responsible for ensuring that a broad view is taken without undue emphasis on any one particular component or subject. In addition, he must ensure that the day to day running of the department is as smooth as possible. The head of department usually has a teaching role similar to that of his colleagues. In the school, teachers have been engaging in teaching 21 lessons per week out of 25. Each lesson lasts for 50 minutes. The first lesson starts at 8.35 with a tutor and the 5th lesson ends at 3.30. All science teachers are accredited to teach year one to seven. Each teacher can teach science courses, but only specialised teachers teach separate biology, chemistry and physics in year three to seven. There is a departmental meeting once a month, but frequently there are informal meetings during lunch time and tea time. The department encourages its member to organise field trips, visits to chemical industry and science club etc.

5.4.2 Courses taught and schemes of work

The department follows a number of syllabuses from NEA and JMB (appendix I). A team of teachers is responsible for producing teaching schemes and teaching materials. A team of teacher is responsible for producing each scheme of work. There are three in-charge in producing teaching schemes for year one to three, whereas prescribed text books are used for year four to seven. However, they have their own notes to boost teaching effectively. The production of teaching schemes is based on the syllabus. The syllabus is broken down into different modules e.g. module on water, air etc.(Appendix O). Each module has been broken down into topics. Looking at a module of water, it is divided into eight topics and a topic begins with the "Looking at different types of water". Each topic is concerned with a syllabus objective. In the module it is indicated which topic contributes to meet particular syllabus objectives. The allocated time for each topic is one to two periods and materials are listed which are required to demonstrate or to do the practicals. A heading of teachers notes explain about the outcomes from the lesson and the sequence of teaching for the teachers. At the end of a lesson, homework or activities at home for students is also shown. During the summer vacation, the department organises a residential session for 2-5 day in order to review and revise the scheme of work each year and the department also supports its less experienced and new teachers by providing teaching schemes, briefing on appointment, leading by head of department and in-charge of the group and taking part in-service training.

5.5 School E

School E is an independent school. it is also a school which is forward looking at a time of unprecedented educational change. Its co-educational, wide-curriculum and modern facilities are testimony to this.

5.5.1 Structure of the school

The school also has its own junior school and they are close to each other. The junior school is both a day and a boarding school for 290 boys and girls from the ages of 8 to 13. The vast majority of its boys and girls go on to the senior school. Those who continue their education at school E are not required to take the common entrance examination since their work and progress will have been carefully monitored and assessed through their continuous internal testing. Like its junior school, the school provides a high standard of education to nearly 500 boys and girls, boarding and day pupils between the ages 13 and 18. They aim to develop each individual pupil with a view to producing independent, self-confident young adults. The teaching throughout the school is by highly qualified specialists and in groups of a size appropriate to the course, its levels and the ability of the pupil.

5.5.2 Academic and pastoral care

Care for the individual is the key to the pupils' high rate of

success. Each boy and girl is a member of one of eight houses, and the housemasters, under the general guidance of the headmaster, are responsible for their pupils' academic supervision and pastoral care. All members of staff are house tutors and every pupil is assigned to a tutor who takes a personal interest in the general well being of the students in his or her care.

As always, academic progress is regularly monitored, and this is ensured by a system of monthly assessments, interim reports and staff discussions. These assessments and reports are studied by tutors, housemasters and the headmaster, and appropriate action is taken when necessary. A full report is made on each pupil at the end of the Christmas and Summer terms, and tutors write fully to parents at the end of the Easter term.

The school believes successful education requires a combination of dedicated staff, motivated pupils and interested parents. They encourage parents to take an active concern in their son's or daughter's work and progress. Opportunities for parents to meet with the headmaster, housemaster or tutor for pupil review can be arranged.

5.5.3 Curriculum for GCSE and A level

Pupils entering the school at 13 follow a particularly broad curriculum for the first year. All pupils have courses in computing, physical education and aspects of personal and social development. In the school, the course chosen is NEA syllabus A which covers both the principles of chemistry as well as the application of chemistry. In the chemistry department, much emphasis is put on learning from

experiments. The work provides a good basis for further study or for understanding the chemistry in the world if no further study is taken.

The examination comprises two papers, the first being taken by all pupils and offering grades G to C. The second paper examines more difficult parts of the syllabus and is taken by the majority of the pupils and leads to grades A and B. The decision as to whether to take paper one only is made in December of the fifth year. It is a joint decision by teacher, pupil and where possible the parent, after recommendation by the teacher. The decision is not dictated by the set the pupil is in.

Practical work is assessed internally as part of normal class practicals. Internal assessment of practical skills accounts for 20 percent of the final total mark.

During the Easter term, fifth form pupils will have to choose the subjects which they are likely to study in the form leading to A level examinations. The school offers JMB syllabus B for the chemistry : physical, inorganic and organic. The course is taught in topics such as rates of reaction, energetic, transition metals. Many of the topics were introduced in the various GCSE courses. At A level the same topics are again studied, but to a greater depth and new ones introduced. Practical work plays an important part in the course. Approximately half of the lesson time is spent on practical work. As with GCSE, the practical work is internally assessed and in this case accounts for 12 percent of the final mark.

5.5.4 Composition of science/chemistry department

The science department is an advanced, modern and well equipped department in the school. It is divided into three separate sub-departments chemistry, physics and biology. There are altogether 8 full-time science teachers and three lab. technicians.

Head of biology	Head of chemistry	Head of physics
|	|	|
Assistant teacher	Assistant teacher	Assistant teacher
Assistant teacher	Assistant teacher	Part-time teacher
		Part-time teacher

* 3 lab. technicians

The chemistry department is well equipped with a team of three full-time chemists including a head of department. The head of department has to take full responsibility in order to run the department smoothly. In the chemistry department, there are three newly built chemistry laboratories which are the main attraction for the students of chemistry. Each and every teacher has got a big classroom cum laboratory where students come for study according to the timetable. Students are not allowed to enter into the laboratory in the absence of a teacher. In this year, there are 312 students studying chemistry from 3rd form to upper A level in the school.

3rd form ----- 100 students into 4 sets

4th form ----- 80 students into 4 sets

5th form ----- 80 students into 4 sets

lower A ----- 26 students into 3 sets

upper A ----- 26 students into 3 sets

The department uses single, double and triple lessons according to the course of study (appendix J) and each lesson lasts for 40

minutes.

One of the interesting features of the science department is an egg race, which has been organised by the science department every year in order to create new ideas in the scientific area. In this race, one student is chosen from each form to set up a group with five members. More than 10 groups will take part in this competition. A project is given to the group with the same materials and the same time. An attractive prize is presented to the group producing the best model. It encourages students to build new creative ideas with contributions from both junior and senior members of the group.

5.5.5 Schemes of work and the department

Individual teaching styles exist in the department. However the department set up a method to produce schemes of work based on the syllabus. Syllabuses are split into separate topics and again the topic is broken down into sub-topics according to age group and made into an order. The following influenced the preparation of the teaching schemes.

(a) Practical using Nuffield course

(b) Awareness of new materials and trends

In the department, there is no formal way to review and revise schemes. When there are new materials and technologies developed, then they think about the revision of their teaching schemes. There are many ways to support less experienced teachers. The department supplies new teachers with teaching schemes, detailed notes and teaching materials, which shows the available materials for practical work. The head of department very frequently makes

personal contact with these teachers. Not only to support less experienced teachers but also encourages its members to extend the range of student activity in order to improve learning styles, conducting science club, physics club and chemistry club. Furthermore, the department invites at least six speakers related to science in a year.

5.5.6 Facilities and activities

The school has a long tradition of sporting achievement. Physical education is a part of the curriculum and there is an extensive games programme and excellent sports facilities because they have own their large sports centre. The science centre is modern and well equipped and provides for the teaching of electronics, computing, design and technology on a generous scale. The school also possesses a fine drama centre, music school and well equipped art and pottery department. The school is a full member of the independent schools careers organisation and all the boys and girls receive the many benefits of the abilities tests and occupational interests interviews by the careers staff. The school encourages parents to be closely involved in the decisions concerning the future of their sons and daughters and the careers staff meets with parents to discuss these important matters.

The school frequently arranges educational tours to different countries and holiday expeditions are an exciting features of the school's life.

The school is proud of its long history and its academic and sporting traditions.

5.6 College F

The college opened in 1985 as part of the 16-19 full time educational provision for students resident in the city of York. There are about 61 teachers in all and 750 students are studying from foundation course to upper sixth form and it is a co-educational college. The ratio of teacher to students is 1:12. Each year, the college has enrolled about 400 new students. The college day differs from that in most schools. There is no registration first thing in the morning and the day begins with first lesson at 8.50 a.m. There are 8 periods each day (except Wednesday when the afternoon is slightly longer and has four periods in it).

5.6.1 Courses taught in the college

There are two types of course available at the college (appendix K).

(a) One is the two year course of academic study which leads to A level and or AS level and possibly GCSE qualification. From this students go on to a wide variety of higher education and other courses or into appropriate employment.

(b) The other course is the foundation course, designed for those students who have not achieved the GCSE results they need to continue in their chosen career. A student wishing to improve basic GCSE qualifications can join the foundation course. Students on this course will spend the majority of their time on five GCSE subjects. The college usually has 90-100 students on this course every year.

Most other students will do three A level subjects taken from the

range of subjects. Guidance is given on the overall suitability of courses chosen by students when senior staff interview them during the fifth year. All two year students will also have in addition to their examination courses, an opportunity to participate in sport and leisure, general education and community service alongside the foundation course students.

For most two year students about three-fifths of their time will be spent on examination subjects. Some of the remainder will be for private study but a very important part of the college time is devoted to non-examination activities which serves to enhance and broaden experience during the two years at the college. These activities are in three broad categories.

(a) General education

(b) Sport and leisure

(c) Community service

Every student is a member of a tutor group, which meets daily for registration, and for a longer period. The tutor plays an important part in guiding students during their time in the college, from the early days of helping them to settle in, through to their departure for higher education or employment. The tutorial programme includes individual and group work, and helps students to develop their potential in a variety of ways. It is supported by presentations from visiting speakers when appropriate.

5.6.2 Admission procedure

During October/November, members of the college staff will visit schools either in the evening or during school time. They talk in

general terms about the college, its opportunities and requirements, to fifth year pupils at city 11-16 schools, Copies of the prospectus and course details will be issued to the schools at this time.

Later in the term there will be two opening evenings when students and their parents come to look around the college and meet some of the subject teachers. During these evenings there will be a short talk about the college and its admissions procedures.

After Christmas, some specialist subject staff will visit the secondary schools to present information about their particular subjects. It is hoped that the application forms can then be completed in time for individual interviews with prospective students to be held in the schools in the second half of the Easter term. These interviews are not selection interviews, they are to give each student the opportunity of discussing proposed courses with a senior member of staff, who will offer advice and guidance where necessary. Interviews for students at other schools are normally held in the summer term.

5.6.3 Structure of science (Chemistry) department and organisation within the department

Science department is one of the largest department in the college. The department is split into three separate sub-departments called biology, chemistry and physics. There are altogether 12 science teachers and each department has 4 specialist teachers. Three laboratory technicians help the teachers to organise and prepare demonstrating materials and practical work. One of them is in-charge of the laboratory and also works during the college vacation period.

There is no overall head of department in science. Each sub-department has a position for head of department and under him other teachers called assistant teachers. Some assistant teachers do some extra duty apart from teaching such as deputy headmaster, administrative officer etc. One of the chemistry teachers looks after administrative duty but he has fewer lessons in order to maintain the time for administrative work.

The course followed is the Nuffield chemistry course. The basic material is contained in two Nuffield text books and is divided into 18 topics. The book includes instructions for practicals and homework questions.

The department has a policy of actively offering help when required in informal extra lessons.

The chemistry department organises a series of outside visits. A trip to the ICI plant at Billingham and other trips to Rowntree laboratories and a university chemistry department prove to be worthwhile.

Since the college opened in September 1985, the average pass rate in A level chemistry in the college over the three year period is 89.6 percent compared with the JMB average pass rate of 74.2 percent over the same period. At present 65 students in the upper sixth and 74 in lower sixth are doing the chemistry course in the college and are arranged into five groups in which the maximum number of students is 17 and the minimum 10.

5.6.4 Schemes of work and co-operation in the department

There is no departmental directive in the selection of methods to

prepare teaching schemes in the chemistry department. Teachers can use their own ideas in order to improve the teaching schemes and teaching methods. However, there is great co-operation among the teachers. Every week, they will have a departmental meeting and discuss about their progress on topics including difficulties in teaching a particular topic. Very often, the teachers do exchange their prepared hand-outs among themselves which they find appropriate and easy for teaching and learning. The presentation of the teaching scheme is guided by the Nuffield course. Less experienced teachers to Nuffield are supported by the head of department providing one to one talking and supplying hand-outs. The department encourages its member to extend the range of student activity but it depends on teacher to teacher since the department has no directive. Teachers very often use videos close to the topic of the lesson. Teaching schemes are very often reviewed and revised in an informal way for minor changes.

5.7 School G

School G is an independent school in the capital of Scotland. It consists of two schools. The preparatory school and the upper school. The preparatory school is for nursery to 11 year boys whereas the upper school provides education for the boys from age of 11 to 18 and girls 17 to 18. The upper school provides a high standard of education to 600 pupils among them 30 girls studying only at A level. The school is staffed by about 67 experienced teachers who spend much time and care on their pupils both in the classroom and out of school.

The school also offers education for junior pupils in a preparatory stage. In the preparatory school class sizes are between 20 and 24 whereas in the upper school, 100 boys are in each year group and are divided into four or five classes. Although the school was founded as a school for boys, by this time they have admitted girls at the appropriate stage for one year or two year courses leading to A level. There are three attractive boarding houses situated in a pleasant part of the city. One house is for boys aged 8 to 13 years and girls of VIth and VIIth years, and another two houses for older boys. Between them, they provide accommodation for about 100 pupils, initially in dormitories and common rooms, but for the final two or three in individual study bed-units or in study bed rooms.

5.7.1 Courses taught and curriculum

The school curriculum is designed to give pupils all the advantages both the English and the Scottish system (appendix L).

The preparatory school curriculum is designed to lead smoothly into the work of the upper school and boys move from one to the other without further examination.

In the first year of the upper school, from Ist to IVth class, all boys study English, Maths French, History, Physics, Chemistry and Biology and two further subjects, initially Latin and Geography but later allowing as alternatives Greek, German, Russia, Art or Music. Any of these subjects can be continued throughout a pupil's school career. All pupils have weekly periods of religious education and physical education and time is given to Art, Craft, Music, Drama and Computing throughout the first three years.

In the Vth class, one subject is dropped and pupils are presented for GCSE or its Scottish counterpart in eight subjects. Thereafter, students work for Scottish 'higher' usually in one year, or for A level in two years. A levels with their university style approaches, form an ideal preparation for any degree course and are the usual basis for entry to the universities of Scotland and to institutions of further education. Many boys go on from higher to A levels in one further year. Pupils are also prepared for entrance to Oxford and Cambridge.

Apart from the curriculum, other activities open to pupils include electronics, computing in various forms, book binding, video camera work, photography and printing. Many clubs and societies meet regularly and senior pupils play a large part in organising scientific, mathematical, art, political, historic etc. societies.

5.7.2 Structure of Science/Chemistry department

The department is housed in three separate buildings in which there are in total twelve laboratories (each department consists of four laboratories), one project room, one lecture theatre in chemistry department and one laboratory in Biology department conjunction for electronics. There is a high level of resourcing and the equipment needed for work which has a heavy practical bias.

In the department, there are twelve full-time and two part-time science teachers. Every member of the department is a well qualified specialists who has been teaching in the school for a minimum of twelve years. Three full-time and one part-time laboratory technicians help the teachers to run practicals smoothly during the

lessons. Every member of the science department takes 35 period per block (week). Each lesson lasts for 40 minutes and most of the science lessons have two periods. Teachers have a free hand and individual teaching styles are allowed in the department. So that there is no lesson plan and formal scheme of work for A level.
Science subjects has been a fascinating subject in the school. The department follows Nuffield syllabus for A level pupils. A level sciences are flourishing with two sets in each of the upper and lower sixths taking biology, chemistry and physics

5.7.3 Schemes of work in the department

The department prepares their own syllabus for junior pupils and the syllabus is divided into different topics for each year, relevant to pupils development. For example - sexual reproduction in biology is introduced in year four. When preparing teaching schemes, at first the head of department sets up the framework and it is presented in a departmental meeting. On agreement between teachers and the head of department, at least one topic is directed to each teacher for preparing the teaching scheme. Then there will be a meeting for the discussion on the prepared teaching schemes. Afterwards the prepared teaching scheme is used by another teacher. There is no particular teaching method presented. The experience of the teachers is greatly appreciated. Individual teaching styles are allowed. However, the department supports its less experienced teacher in various ways providing teaching schemes, paper work, policies of the department, good communication within each year group, observing lesson etc.

The department encourages its members to extend the range of student activities in lessons particularly on new experiments, projects, video and taking part in the science festival. Organisation of activities depends on the willingness of teachers. Most of the teachers have organised various activities after lessons like science society, animal club etc. If a good idea emerges at the departmental meeting for activities, they will be discussed and praised by the head of department and encouraged to go ahead. The syllabus changes at regular intervals. Any teacher can suggest minor changes but major changes are influenced by outsiders and the board of governors.

5.7.4 Everyday life of pupils

Pupils have to report to their class teacher at 8.45 from Monday to Friday and then be present in the hall for prayer. There are seven teaching periods and day ends at 3.05. After this all pupils play games on two afternoons a week, and on the other days they have a period of quiet reading or time spent on a chosen activity, under the guidance of a member of staff, usually ending at 4.00. On Friday afternoon at 5.00, there is an opportunity for societies to meet. There are no lessons on Saturday but matches for all age groups are played against other schools. Homework is set on five days, varying from one hour to two or three hours according to the pupil's age.
The great majority of pupils achieve their academic purpose by sustained hard work. Four pupils out of five go onto university, and the rest go to higher education or to directly vocational training.

5.8 School H

The school is situated a mile or so from the town centre of Scarborough in a pleasant situation. It is a county comprehensive school for boys and girls from 11-16 years of age. The school provides education to 1000 pupils of Scarborough surroundings and has 56 qualified teachers.

5.8.1 Tutor system

Each year the school enrols roughly 200 pupils in the first year (National Curriculum year seven). After admission, first year pupils are assigned in a tutor group with approximately twenty five students of all ranges of ability and from village and local primary schools. Each tutorial group meets together for twenty five minutes in the morning and for a few minutes in the afternoon . The responsibility of the year tutor is to keep an eye in the overall development and welfare of each individual youngster within that year group and also involves interviewing and advising when youngsters have problems or difficulties.

5.8.2 Taught courses

In the school, students are able to take courses leading to the general certificate of secondary education or the foundation subjects. Foundation subjects are available for pupils who would experience difficult with certain GCSE subjects.

Each student follows a programme which is made up of compulsory and optional subjects. Compulsory subjects cover twenty eight periods out of a forty period week and the remaining twelve periods are retained for optional subjects.

5.8.3 Science curriculum

Science is a core subject in the school curriculum and occupies 20 percent of time table in years four and five. The course followed is co-ordinated science (the Suffolk development) which is a balanced science course leading to the award of two GCSE subjects and results in a double grade AA,BB etc. The head of department said that the course is a suitable for the whole ability range and is assessed at three different levels depending on the progress made by the student. The course lasts for three years (13-16) therefore students start their studies in year three (Appendix M) .

As mentioned above the course is balanced in that it consists of 33 units which are divided equally between the main subjects area of biology, chemistry and physics and are taught by subject specialists.

In the first two years pupils follow an integrated science course based on 'Active Science' which encourages them to develop their scientific skill through a wide range of practical activities.

The assessment of pupils progress is an integral part of their learning and is strongly formative in that it helps pupils to improve their confidence, knowledge, skills and understanding of the subject. Assessment takes place in each unit throughout the three years of the course and the marks contribute to the final GCSE

grades. There are three ways in which each unit is assessed.

(a) End of unit tests : It covers 45 percent of the total mark. At the end of each unit a pupil takes one of the three short tests. These are set up by the Midland Examining Group and are marked by the teachers.

(b) Process skills : These skills are assessed during the course of the unit and 45 percent of the marks are reserved for skills. In this area planning, observing and investigation are examined.

(c) Simple practical test : One or two simple practical skills called 'can do' test are assessed during the course of each unit. The test covers 10 % marks and skills are such as using a Bunsen burner, focusing a microscope, reading a meter etc.

There are no end of course examinations, since the course is continuously assessed.

The science department manages a range of other activities in order to support the curriculum and activities including field trips, visits to museums and universities, a science shop and a natural history society.

5.8.4 Structure of science department and its schemes of work

The department consists of six laboratories. The design of the area allows all students to participate to the maximum in practical studies. There are eight staff involved in science teaching and they are assisted by two laboratory technicians. Each teacher has to teach thirty four lessons per week out of forty lessons but the head

minutes. Students are generally taught in mixed ability sets in their initial years in the school, however, there is a best set from year three onward. Each year is divided into eight groups containing normally 25 students in each group.

Science staff have been working to produce schemes of work in order to teach the pupils effectively. The method used to produce a scheme of work is based on published schemes for year one and two "Active Science" and Suffolk Co-ordinated Science is followed for year three to five. The staff use their time to prepare schemes of work during the Summer time or INSET courses. The production of teaching schemes is part of the departmental schedule. The following factors have influenced the method of presentation of the teaching schemes :

(a) county document on "planning, assessing and recording key stage 3"

(b) need to have consistent approach across the department

(c) lessons to be manageable

(d) accountability to parents and advisers

(e) resources from technicians - cards

There is a continuous informal system for the revision and review of the schemes of work leading to minor changes. Formal review and revision of scheme of work is conducted in the department once a year after the discussion with the departmental members. The department supports its less experienced teachers or new teachers in different ways - providing existing schemes of work, advising on teaching methods or taking part in the moderation meetings with other schools about the course.

Overall the science department in the school aims to provide a balance between knowing scientific facts and using scientific

process and skills. They use a wide range of teaching strategies through which pupils are expected to develop their personal study skills and become good learners.

CHAPTER VI

CONCLUDING DISCUSSION

The conclusion aims to summarise the activities performed during a one year study period. It focuses specifically upon the outcomes and findings of school visits and the management of the science departments and the implications for my own work at the Budhanilkantha school.

The purpose of this report was to acquire knowledge of the educational system of the United Kingdom and exploit some suitable approaches in the unique national English-medium boarding school in Kathmandu, where prince and son of poverty-stricken family study and live together for about 7 years.

Where the medium of instruction is in English, the language is the most fundamental element to deal with for the students in the class room as well as within the school compound. The improvement of my English language during my study by attending English lessons provided by the Language Teaching Centre and communicating with British people is of benefit to my teaching since the school is an English-medium school. On the one hand, the English course enabled me to produce the report in this form. On the other hand, English conversation with the English speaking groups during the study period made me more confident when conversing in English. The confidence will be reflected in delivering subject matter more easily while teaching in the classroom.

During the first and second terms, a number of chemistry practicals

from Nuffield Chemistry Book (Appendix A) were performed in the Science Education Laboratory, which helped me to recover and broaden my practical skills. The attendance at undergraduate chemistry classes and in-service courses with U.K. teachers will be a great asset in teaching chemistry for A level students. Not only was it an opportunity to acquire knowledge of the subject matter, but also there was a chance to observe the methods of teaching and demonstration procedures used while the experienced lecturers taught in the classroom. In addition to attendance at classes, the participation in ASE and BAAS meetings, additionally assisted indirectly in teaching science and chemistry and enabled me to become acquainted with various examination boards' syllabuses available in the United Kingdom and Cambridge GCSA and GCS-O international examination procedures. It was also possible to collect many examples of teaching materials and to observe new scientific equipment in the exhibition. These aspects also will prove to be worthwhile in assisting with the teaching of Cambridge O and A level in the school as well as in ordering new teaching materials for the school. In the meetings, there were workshops, lectures, programmes of talks, symposia and also I met many well known science educators, from whom I learned of some new aspects of teaching methods and changes of curricula.

I found one of the interesting features of activities from the school visits was an egg race. The race has been organised by the science department of school E every year to create new ideas in the scientific area. This race will be new for Budhanilkantha and can be exercised by the students from year 10 onwards to extend the range of student activities and to create new idea in the scientific area. This type of race will encourage the boys to apply their ideas and

skills in practice.

The learning of word processing skills on the BBC and Vax computer will help me in the preparation of questions and schemes of work and also to run a computer club for students.

Either in education or in any other subject area, a careful enquiry brings new information and by using the new information, existing knowledge can be expanded or verified. In addition to verification or expansion of existing knowledge it aids in the construction of theories and principles. The series of education seminars organised by the Education Department for MA students and staff on various issues allowed me to become familiar with a range of research methods and their use to investigate current problems in education. The issues included Education in Papua New Guinea, Issues in science education in Southern Africa and Investigating children's ideas in science. The seminars not only concentrated on science education but also on other subjects areas such as Head of departments' perception of the teaching of mathematics, Language teachers at work, Working advisory teachers : roles and rituals .

Recently Budhanilkantha school has started monthly seminars for teachers to discuss different aspects of education aiming to develop new policies and improve pedagogies at the school. The involvement in the staff and MA student seminars will help me to take part confidently and to put new ideas, arguments and to implement some new teaching technologies gained from the seminar.

6.1 MAIN CONCLUSION FROM SCHOOL VISITS

6.1.1. Structure of science departments

The science department is one of the major departments in most schools. The number of science teachers varies according to the number of students studying in the schools. A comparison of schools C and A is interesting. School C is an independent school, it has 24 science teachers for 1270 students, whereas in state school A the number of students is 1500 and teachers 16. In general, the ratio of science teachers to students is higher in independent schools than state schools. Table 1 presents the number of students, number of teachers, laboratory technicians and existence of sub-departments for each school visited. The majority of the independent schools have a high ratio of teacher and laboratory technicians to students compared to the state schools.

The head of science has to take full responsibility for the science department in order to run the department smoothly where sub-departments are not established. The majority of sub-departments (where the responsibility of science department is shared between three heads) are reported in independent schools.

Generally it was found that science teachers are not only dedicated in teaching science but also to some extra duty on administrative work such as being a deputy headmaster. Teachers are more well qualified and experienced in the independent schools than the state schools visited. I believe, this is because of the more attractive salaries and facilities in independent schools.

Each science lesson lasts for 35 to 40 minutes and most of the

schools prepare double lessons for science.

School/ College	No. of Students	No. of science Teachers	No. of Lab.Tech.	Nature of school	Existence of sub-department
A	1500	16	3	state 11-18	No
B	950	10	3	state 14-18	No
C	1270	24	5	independent 13-18	Yes
D	1000	12	3	state 11-18	Yes
E	500	8 +(2)	3	independent 13-18	Yes
F	750	12	3	state 16-19	Yes
G	600	12 +(1)	3+(1)	independent 13-18	Yes
H	1000	8	2	state 11-16	No

School visits

Table 1.

6.1.2. Schemes of Work

As mentioned in the chapter three, schemes of work support and provide guidelines for new teachers, student teachers and those teachers who are not acquainted with the subject matter. The statement is widely applied in most of the schools visited in order to help their new teachers. Having access to the existing schemes of work, the new teachers will cope with the new situation more easily. Heads of departments must concentrate to encourage their teachers to

practise in producing schemes of work not only for their sake but also it helps the new comers into the teaching profession.

The nature, origin and use of the schemes of work does vary from school to school. Of course, this is how it should be, because the departments prepare their own schemes of work to suit the nature and policies of their school and department. The methods used to produce teaching schemes are mostly based on the syllabus which is then broken down into workable teaching units or large topics to small sub-topics consisting of both theoretical and practical aspects of the topic. In most of the schools, there is a team leader in-charge of each year who is responsible for organising the preparation of the schemes of work for the year.

There is no departmental directive in the selection of methods for the preparation of schemes of work in independent schools and it is generally thought that teachers can use their own ideas in developing schemes and teaching methods since teachers are well experienced. However, there is still good co-operation among the teachers of those schools so that in departmental meetings, they discuss difficulties in teaching particular topics. In school G (independent), at least one topic should be prepared by each teacher and the prepared teaching scheme is used by another teacher, whereas in the school D (state) there is a teacher in-charge of producing schemes of work to be used by all other teachers who teach that year group. In the first case, there is little interaction among teachers while the scheme is being prepared but in the second case a group of teachers take part and they have a chance to share their ideas. I personally think the second case is more appropriate for the production of schemes of work because their ideas and agreements are shared at the same time. Clearly some of this team work and sharing

of ideas was considered unnecessary in the independent schools. This practice exists because of their confidence in the experienced individual teacher. However, it could be argued that even the most experienced teachers could benefit from the shared production of teaching schemes. The state schools in the sample also appear to have a higher turn-over of staff and so the need to induct new staff occurs more frequently. However, a new member of staff in an independent school could still benefit from the existence of a teaching scheme, which reflected the combined wisdom of the existing staff.

Availability of teaching materials, experience of the teachers and the examination syllabuses being followed also influenced the preparation of the schemes of work.

6.1.3 Support to other teachers

Obviously, inexperienced teachers need some sort of support from existing members of the department to become familiar with the system of the department and the syllabus. From the school visits, the following list of support for less experience teachers was compiled.

Method of support	Found in school
- Providing existing schemes of work	A,B,E,D,F,G,H
- Supported by the head of department providing one to one talk	B,D,E,F
- Taking part in-service training	A,B,D

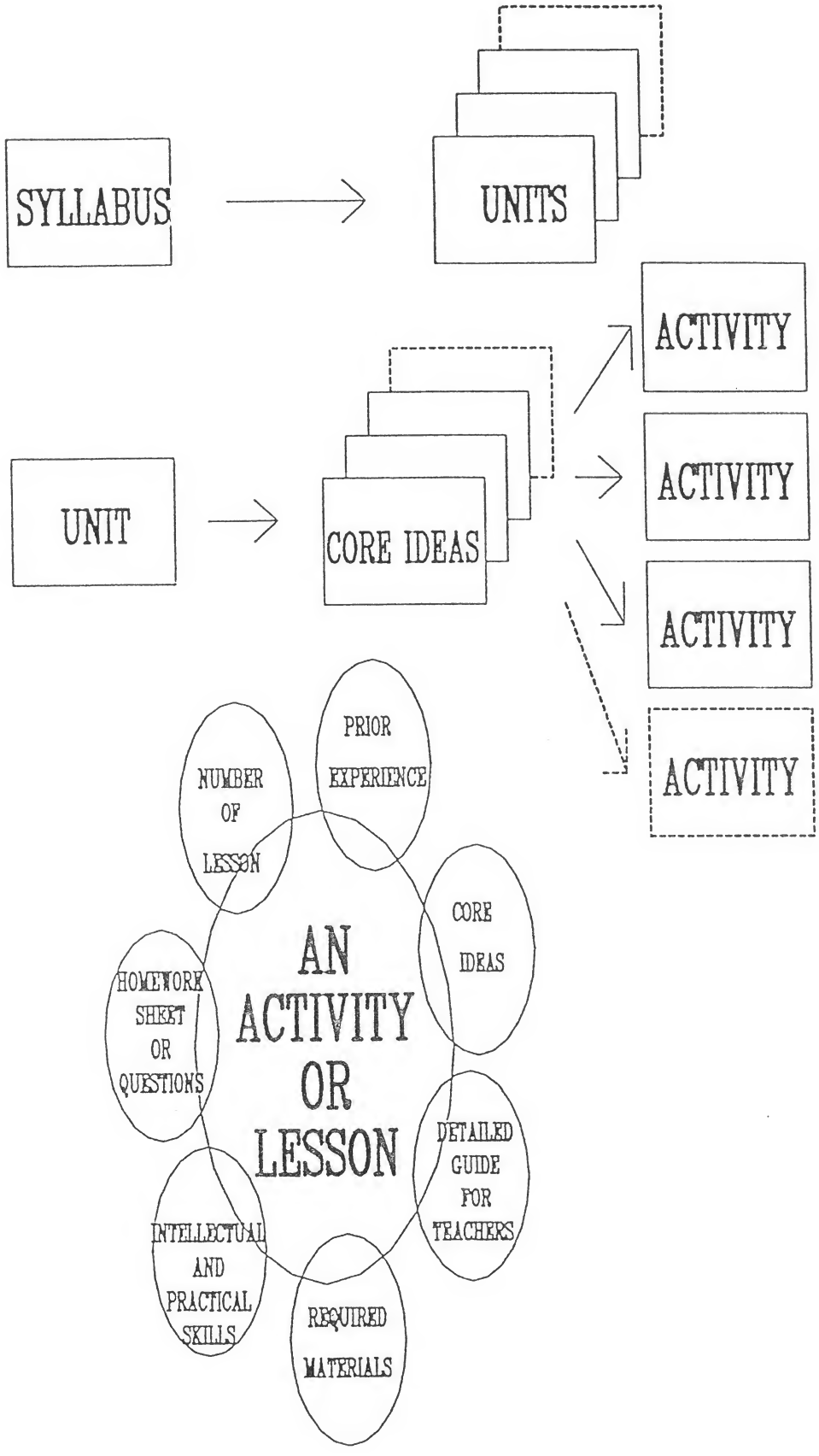
- Supplying hand-outs	E,F
- Briefing on appointment	C,D
- Showing available materials for practical works	E
- Providing individual tutorials from experienced teachers	A
- Advising on teaching methods	H
- Taking part in the moderation meetings with other schools about the course	H
- Providing policies of the department	G
- Making good communication within each year group	G
- Observing lesson	G

The list shows that the most of the science departments have been supporting its less experienced teachers by providing existing schemes of work. Hull and Adams (1981) argued that

> In our view, every course should have a schemes of work, unless there are very good reasons for it not having one. Even when only one teacher is teaching a course, the self-discipline involved in drawing up a scheme of work is valuable and there are likely to be fewer problems of continuity in the teacher's absence (p. 79).

6.2. Implication for my own work

One of the major elements of the study concentrated on the managing of school science departments. Under this heading my work mainly focused on the role of the head of department and the schemes of work. It is the most important topic to be learned by a head of department. In future, the school might offer me the position of head of department. At that time, the study will help a lot in order to maintain and run the science department effectively. The school's science department does not have formal schemes of work in written form since most of the teachers are well experienced. However, three science teachers educated from this university have realised that the schemes of work are most important in order to deliver courses effectively and easily, and that, even for experienced teachers, to produce and continue to review and develop schemes of work will enhance the courses provided in the school. In order to meet the objectives of the syllabus, it is necessary to expand the syllabus producing a scheme of work. There are many methods used in schools. The guidelines will be very supportive for new teachers in the preparation of their lessons. At first the syllabus should be broken down into workable teaching units in a sequential way and each unit should consist of core ideas which have to be covered in the unit. The time factor is also great importance in the preparation of schemes of work and time available for the syllabus should be calculated. A lesson can be delivered in different ways making activities or modules.



GUIDELINES FOR THE PREPARATION OF SCHEMES OF WORK

Figure 2

The following are guidelines as to what should be included in the description of each activity.

a) Number of core ideas (mentioned in a unit) which have to be covered in the activity

b) Number of lesson needed for the activity

c) Indication of intellectual and practical skills which showing what skills will be developed by completing the activity

d) Level of student

e) List of required materials to perform the activity and where they are stored

f) Detailed guide for teachers for each activity

g) At the end of the activity what kind of homework has to be given

h) End of unit test and progress test

So much has been discussed about the importance of schemes of work, that it can be concluded that a scheme of work is an indispensable element in ensuring the effective delivery of the syllabus. A consideration of the purposes of schemes of work and the methods of production will be of benefit to my own work in the preparation of schemes of work. The major advantage of the understanding and the preparation of schemes of work will be evident when implementing them in my school.

The school visits were of great help in learning about the physical facilities available in the schools, management of the science departments and laboratories, schemes of work and the methods used by staff in the preparation of teaching schemes, the different ranges of student activities used and the types of syllabuses and examination boards available for A and GCSE level student.

The participation in a one week intensive course on management of science curriculum at the Education Department with British teachers has helped me to understand in detail about the National Curriculum. Similarly, the participation in a one week course on Chemistry, Industry and Environment at the Department of Chemistry also helped me to understand more about how to teach the subject in the school and its application in the future. I was also able to take part in the production of some teaching activities for students and had the opportunity to share ideas concerning management of courses with other teachers during the course.

The visit to schools was notably beneficial. On the one hand I have had a chance to learn how to prepare questions for discussion and the method of enquiry which will reflect on my further research work, particularly in the field of education. It will help me to do research work within the school into different aspects of education. On the other hand I was able to understand about the management of science departments. It is clear in my mind that the head of department has to play a leading role and must have well defined responsibilities. In order to perform the responsibility, a single management style may not be appropriate. Very often consultation with the departmental staff is required to satisfy the needs of the departmental members. A skilled head of department can modify the whole attitude and performance of the department.

During the period of study 1989-90, almost all of the objectives mentioned in the first chapter have been covered by undertaking various activities within and outside the university.

In general, the one year study on applied educational studies will reinforce the effectiveness of my teaching, assist in the preparation of schemes of work as well as in organising the science

department effectively through various activities. Furthermore, the acquired new ideas, experiences and teaching techniques will contribute generally to the benefit of students and colleagues in teaching and learning at the school.

Appendix A

The List of practicals done during the period of the study in the laboratory of Science Education Department

The following practicals were extracted from the Nuffield Science A-level Chemistry course in order to revise and update :

Serial No.	Experiment No.	Title of experiments
1.	2.3	To find the solubility of calcium hydroxide in water by titration
2.	2.5	To investigate the solubility of some salts of group II metals
3.	3.4 (a)	To find the relative masses of molecules of gases
4.	5.3 (b)	To investigate the reactions between halogens with alkalis
5.	5.3 (d)	The preparation of potassium iodate(V)
6.	5.3 (e)	The reaction between iodine and sodium thiosulphate
7.	5.3 (f)	To determine the purity of samples of potassium iodate(V)
8.	6.2	To find the enthalpy change for some reactions
9.	6.3	Evaluating an enthalpy change that cannot be measured directly
9.	6.4	To find the enthalpy changes of

		combustion of some alcohols
11.	9.5 (b)	The nitration of methylbenzoate
12.	10.3	How does the boiling point of a mixture of propan-2-ol vary with its composition
13.	12.1	The distribution of ammonia between water and 1,1,1-Trichloroethane
14.	12.4	An investigation of the reactions of ethanoic acid
15.	13.2	An investigation of some reactions of carboxylic derivatives
16.	13.3	An investigation of the reactions of amines
17.	14.2 (a)	The kinetics of the reaction between calcium carbonate and hydrochloric acid
18.	14.2 (b)	The kinetics of the reaction between iodine and propanone in acid solution
19.	14.3	The effect of temperature on the rate of the reaction between sodium thiosulphate and hydrochloric acid
20.	14.4	A kinetic study of the reaction between manganate(VII) ions and ethanedioic acid
21.	16.2 (c)	Estimation of the percentage of iron in 'ferrous sulphate' tablet

22.	16.3 (a)	An investigation of some copper (II) complexes
23.	16.3 (c)	The preparation of some compounds containing complexes
24.	18.2	Boric acid and aluminium hydroxide
25.	18.3 (a)	Preparation of some oxide of tin and lead
26.	18.3 (b)	Comparison of tin(IV) oxide and lead(IV) oxide
27.	18.3 (c)	An estimation of the percentage purity lead(IV) oxide

Appendix B

The List of A-level Budhanilkantha school graduates and their places

Year : 1988 (November)

No. of students appeared in the Examination : 21

Pass rate : 95%

Universities	Subjects	No. of students
* Calcius College, U.K.	Engineering science	1
* York University, U.K.	Electronic engineering	1
* St. John's College, U.K.	Engineering science	1
* Queen Mary College, U.K.	Electronic engineering	1
* Liverpool University, U.K.	Civil engineering	2
* Bristol University, U.K.	Electronic engineering	1
* Bradford University, U.K.	Electronic engineering	1
* ....., U.S.A.	.....	1
* Knox University, U.S.A.	Liberal arts	1
* Davidson University, U.S.A.	Liberal arts	1
* Colby College, U.S.A.	Computing	1
* Ohio Weleyn University, U.S.A.	Liberal arts	1
* ....., India	..... engineering	1
* Tribhuvan University, Nepal	Science	1
* Nemzetkozi Elokeszito Intezet Hungary	Prog. Maths	1
* ....., India	Engineering	1
* ....., India	Medicine	1
* ....., Bangladesh	medicine	2
* Sir Salimullah Medical College, Bangladesh	Medicine	1

Year : 1988 (November)

No. of students appeared in the examination : 14

Pass rate : 100%

Universities	Subjects	No. of students
* Christ Church, U.K.	Engineering science	1
* Wadham College, U.K.	Engineering science	1
* St John's College, U.K.	Biology	1
* Bath University, U.K.	Chemical engineering	1
* Manchester University, U.K.	Computer systems	1
* University College, U.K.	Chemical engineering	2
* Brandies University, U.S.A.	Pre- medical	1
* ....., Japan	.....	1
* ....., U.S.S.R.	Pharmacology	1
* ....., Korea	Civil engineering	1
* ....., Bangladesh	Medicine	1
* ....., India	Electrical engineering	1
* Shree venketswor College, India	Civil engineering	1

Appendix C

Budhanilkantha School

Science Curriculum Map

Class	Age	Period/week	Course
4	9	4	Integrated science (Science Today part I & II)
5	10	6	Integrated science (Science Today part III & IV)
6	11	6	Integrated science (Science 2000 part I)
7	12	6	Integrated science (Science 2000 part II)
8	13	2 each	Physics, Chemistry & Biology (prepared by science staff)
9	14	2 each	Physics, Chemistry & Biology (National curriculum)
10	15	2 each	Physic, Chemistry & Biology (National curriculum)
11 (O)	16	12 + 3	GCE O (Cambridge)
12/13 (A)	17/18	24	GCE A (Cambridge)

Appendix D

Covering letter

University of York

Science Education department

Date : 8/11/1989

Dear .....,

I am a chemistry teacher from Nepal. I am spending this year at the University of York working in the Science education group.

I am interested in the organisation of school departments and in particular the methods used to produce teaching schemes from syllabuses and how departmental documentation supports members of the science department.

I would be most grateful if I could discuss this with you and perhaps obtain some small samples of your teaching schemes. When I visit you, I would, in particular, like to consider the questions on the enclosed sheet.

I look forward to meeting you at ..... on.....

Yours sincerely,

Keshar M. Tamrakar

Appendix E

Departmental Organisation

Discussion Questions

1. What methods are used to produce your teaching schemes?

2. What factors have influenced the method of presentation of your teaching schemes?

3. In what ways does the department support its less experienced teachers?

4. In what ways does the department encourage its members to extend the range of student activities they use in lesson?

5. What methods of reviewing and revising your teaching schemes are used?

Appendix F

School A

Science Curriculum Map

Age	Year	lesson/week	Course
11	7	6	Integrated science
12	8	4	Integrated science
13	9	2 each	Biology, Chemistry Physics
14/15	10/11	6 each	NEA GCSE PCB NEA GCSE modular science (single and double award) MEG GCSE Rural science
16/17	12/13	6 each	JMB A level PCB CAMB A/S level Gen. stds. GCSE Human physiology CPVE - Science base - Integrated science - Agriculture

Appendix G

School B

Science Curriculum Map

Age	Year	Lesson/week	Course
14	4	6	Modular & Integrated Science (NEA)
15	5	6	Modular & Integrated Science (NEA)
16	6 (lower) Each of Physics, Biology & chemistry	6	JMB syllabus A
17	6 (upper) Each of Physics, Biology & Chemistry	6	JMB syllabus A

Appendix H

College C

Science/Chemistry Curriculum Map

Age	Division	Lesson/week	Course
13	F	4	Introduction to Chemistry
			Chemistry - 1st term
			Physics - 2nd term
			Biology - 3rd term
14	E	3	Pre GCSE
			Chemistry - 1st term
			Physics - 2nd term
			Biology - 3rd term
15	D	2 each	GCSE
			Chemistry - 1st term
			Physics - 2nd term
			Biology - 3rd term
16	C	6 + 1	A level Chemistry
		2 double theory	
		2 single practical	
		1 extra	
17	B	6 + 1	A level Chemistry
		2 double theory	
		2 single practical	
		1 extra	

Appendix I

School D

Science Curriculum Map

Age	Year	Lesson/week	Course
11	1	4	Integrated science
12	2	3	Integrated science
13	3	3	Integrated science
14	4	5	NEA
15	5	3	NEA
16	6	6	JMB
	Each Physics, Biology & Chemistry		
17	7	6	JMB
	Each Physics, Biology & Chemistry		

Appendix J

School E

Chemistry Curriculum Map

Age	Form	Lesson/week	Course
13	3	3 1 double 1 single	
14	4	4 1 double 2 single	
15	5	4 1 double 2 single	GCSE (NEA)
16	6 (lower)	7 1 triple for practical 1 double 2 single	JMB
17	6 (Upper)	7 1 triple for practical 1 double 2 single	JMB

Appendix K

college F

Science (Chemistry) curriculum Map

Age	Form	Lesson/week	Course
16	Foundation course	.....	GCSE
17	Lower sixth	8	GCSA
			(Nuffield Chemistry)
		1 triple lesson	
		2 double lesson	
		1 single lesson	
18	Upper sixth	8	GCSA
			(Nuffield Chemistry)
		1 triple lesson	
		2 double lesson	
		1 single lesson	

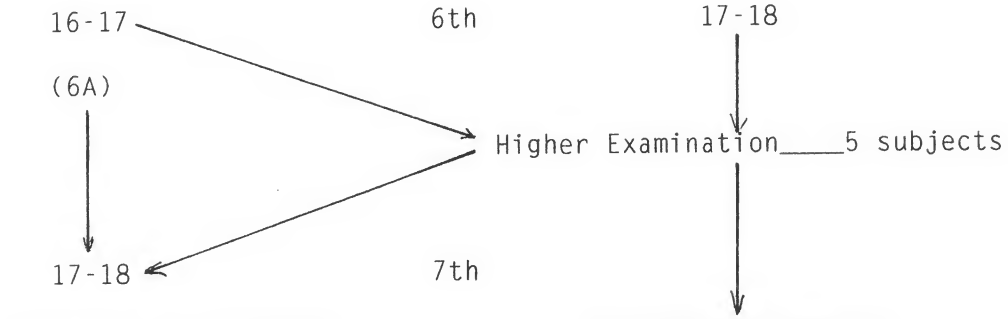
Appendix L

Scottish Educational System in

School G	State School
Primary Year 1-6	Primary Year 1-7
Senior Year 1-7	Senior Year 1-6

Senior Year in

School G age	Year	State School age
11-12	1st	12-13
12-13	2nd	13-14
13-14	3rd	14-15
14-15	4th	15-16
15-16 (GCSE)	5th	16-17
16-17 (6A)	6th	17-18
17-18	7th	



A level (3 subjects)

English University

(3 years)

Degree

Scottish University

(4 years)

Degree

Appendix M

school H

Science Curriculum Map

Age	Year	Lesson/week	Course
12	1	2 double	based on 'Active science'
13	2	2 double	based on 'Active science'
14	3	3 double	Suffolk co-ordinated science
15	4	4 double	Suffolk co-ordinated science
16	5	4 double	Suffolk co-ordinated science

Appendix N

SCHOOL A

Schemes of work

Lower school integrated science course

AN UNIT

ENERGY AND HEAT NC VERSION

Core ideas

1. There are nine forms of energy :- chemical, electrical, heat, light, magnetic, movement (kinetic), nuclear, positional (potential) and sound. (AT 13, Level 6)
2. Energy is needed to get things done and whenever something happens (lights up, heats up, moves etc.) energy is being used. (AT 13, Level 6)
3. Energy can only be used to do useful things when it is changed from one form into another. Often more than one type of energy is produced. The energy is spread around and so is less useful. (AT 13, Level 6)
4. Food is a store of chemical energy used by plants and animals. We can measure how much energy food contains by burning it. (AT 13, Level 1)
5. Some foods contain more energy than others. We must be careful not to eat regularly too much or too little energy foods.
6. Models and machines need a source of energy to work. Often this source of energy can be stored inside the

machine/model. (AT 13, Level 3/4)

7. The sun is ultimately the major energy source for the earth. (AT 13, Level 6)
8. Coal, oil and natural gas are called the fossil fuels because they were formed from dead plants and animals millions of years age. They can be used to provide us with energy. (AT 13, Level 4)
9. A great deal of the energy we use comes from the chemical energy stored in fossil fuels. The world's supply of fossil fuels is being used up and one day there will be none left. In the future alternative sources of energy must be found to replace the fossil fuels e.g. nuclear power, solar power, wind power, wave power. (AT 13, Level 5)
10. Electricity is a very useful source of energy as it is easily transported and easily changed into other forms of energy
11. Solids, liquids and gases get bigger when heated and smaller when cooled. We say they expand and contract. (AT 8, Level 6; At 13, Level 4)
12. Solids change into liquids and liquids change into gases when they are given enough energy. We say the solids melt and the liquids boil. Gases change into liquids and liquids change into solids when they lose enough energy. We say the gases condense and the liquids freeze. (AT 8, Level 6, AT 13, Level 4)
13. Temperature is a measure of the degree of hotness (or coldness) of an object (AT 13, Level 2)
14. Our sense of touch tells us whether things are hotter or colder than our bodies (At 13, level 2)

15. Temperature is measured with a thermometer. The most common scale for measuring temperature is the Celsius scale. On the Celsius scale water boils at 100°C, water freezes at 0°C, normal body temperature is 37°C and room temperature is 18-23°C (AT 13, Level 4)

16. Different thermometers are used for different jobs e.g. maximum and minimum, clinical and soil thermometers.

17. The loss of heat energy can be cut down by insulation. This is one way of conserving our fossil fuels (AT 13, Level 5)

18. Warm blooded animals have various ways of keeping warm and cooling off e.g. fur, feathers, size, shape, huddling, wallowing, sweating, panting.

THINKING AND PRACTICAL SKILLS

This topic provides an opportunity for pupils to assess their progress in the following thinking and practical skills :

1. (b) The ability to measure mass accurately using kitchen scales and a digital balance
1. (c) The ability to measure temperature accurately using a thermometer
1. (g) The ability to measure time accurately using a stop clock
1. (j) The ability to measure the volume of a liquid accurately using a measuring cylinder
4. (g) The ability to record results in line graphs

The end of unit test will include an assessment of the following thinking and practical skills

4. (g) The ability to record results in line graphs
6. (b) The ability to change the presentation of results from tabular form to graphical form
8. (d) The ability to find patterns in observations and results by finding relationships such as "the bigger the ....., the smaller the ....."
8. (e) The ability to find patterns in observations and results by identifying results that are inconsistent with such patterns and offering explanations

PRIOR EXPERIENCE

This unit draws on certain ideas developed in the first three units of the Lower School Integrated Science Course :-

(a) Materials can be either conductors or insulators of heat. (materials Topic)

(b) Warm blooded animals have a constant body temperature whereas cold blooded animals are at the temperature of their surroundings (Variety of life topic)

(c) Evaporation is when a liquid turns into a gas (Introduction to science topic)

SUGGESTED TEACHING ROUTE

Forms of energy and energy changes	1 double period
The elastic roller race	2 double periods
Energy from food	1 double period
Energy in the home	1 double period
Alternatives to the fossil fuels	1 double period
The nuclear debate	1 double period
Heating things	1 double period
Keeping warm	3 double periods
Keeping cool	2 double periods

WORKSHEETS

LSISE 1: Energy in the Life of Jane and David

LSISE 2: Elastic Powered Roller

LSISE 3: Elastic Powered Band Roller : Design 1

LSISE 4: Testing Your Elastic Powered Roller

LSISE 5: Fuel Foods

LSISE 6: The "Hulks"

LSISE 7: Energy Survey

LSISE 8: How Much Oil Is Left

LSISE 9: Will There Always Be Coal Oil and Gas

LSISE 10: Power Station for Bywater

LSISE 11: Chairperson' role card

LSISE 12: Interest groups role cards

LSISE 13: Questions for the debate

LSISE 14: Making Heat DO Work

LSISE 15: Solids, Liquids and Gases

LSISE 16: getting Bigger

LSISE 17: Hot and Cold

LSISE 18: There's Nothing Like a Good Huddle

LSISE 19: Saving Heat

LSISE 20: Missing School party Found safe and Well

LSISE 21: How Can An Elephant Help Cool Your Tea

LSISE 22: Fins Aint What They Used To Be

COURSE | LOWER SCHOOL INTEGRATED SCIENCE (NC VERSION)

UNIT | ENERGY AND HEAT

ACTIVITY | 1. FORMS OF ENERGY AND ENERGY CHANGES

TIME | ONE DOUBLE PERIOD

KNOWLEDGE AND UNDERSTANDING

1. There are nine forms of energy:- chemical, heat, light, magnetic, movement (kinetic), nuclear, positional (potential) and sound. (AT 13, Level 6)
2. Energy is needed to get things done and whenever something happens (lights up, heats up, moves etc.) energy is being used. (AT 13, Level 6)
3. Energy can only be used to do useful things when it is changed from one form into another. Often more than one type of energy is produced. the energy is spread around and so is less useful. (AT 13, Level 6)

INTELLECTUAL AND PRACTICAL SKILLS

4. (e) The ability to record results in table form.

REQUISITION

Lower School Integrated Science energy circus

TV and VCR, Exploring Science video "Energy"

DETAILED GUIDE

This lesson revolves around a circus of devices which use energy (see below - THE RADIATION SOURCE MUST BE SET UP AND UNDER THE CONTROL OF THE TEACHER THROUGHOUT THE LESSON - if you are unsure how to use the radioactivity kit safely then see a colleague in the Physics or Chemistry Departments). The components of this circus will reflect as far as is possible Core Ideas 1 to 3. Staff should NOT requisition extra equipment from the technicians but could supplement the circus with items brought in from home. The energy circus will include a good selection from the following:-

chemical	- camping gas stove or Bunsen burner
electrical	- hair drier or radio or TV
heat	- electric kettle
light	- candle
magnetic	- iron filings on paper over a bar magnet
movement	- solar cell and motor
nuclear	- B source, holder, GM tube, scalar
positional	- wind up toy
sound	- lab pack and electric bell
others	- friction torch
	food e.g. crisps, peanuts
	live animal

Having introduced the subject of the next weeks work, the pupils should visit the items in the display to try and identify the

different forms of energy. Some will be straightforward (movement, heat, light, etc.) whereas others will probably need some explanation (positional, chemical). these could be recorded in the form of a table like the one below :-

Form of Energy	Where it can be found
Chemical	Food
Sound	Radio

By discussion, pupils can now be guided towards a "definition" of energy as described in Core Ideas 2. A second visit to the circus can now be used to identify the energy changes taking place in the various items. these can be recorded as shown below:-

Candle : Chemical ------ heat and Light

Touch : Chemical ------ Electrical ---- Heat and Light

Wind-up Toy : Positional ------- Movement and Sound

The video "Energy" from the Exploring Science series could be used here

---

HOMEWORK AND EXTENSION ACTIVITIES

Draw a picture title for the topic.

Worksheet LSISE 1 : Energy in the Life of Jane and David

APPENDIX O

School D

Schemes of work

First year science course

Module : Water

Topic : Looking at different types of water

Syllabus objective : 1,2,3,5,6,7

Number of lessons : 1

Apparatus : Class set of different types of water in mccartney bottles

Teachers notes : Lesson outcomes 1. to understand what a suspension is

2. to know the names of equipment used

3. a good scientist uses all senses

Collect facts gathered about water

Illustrates water is an important topic

then discuss what a scientist does - uses their senses to observe and record "many people knew about gravity but only the man who wrote about is remembered"

Practical - young people collect samples of water in mccartney bottles and use all their senses to work out where water came from they are from sea, swimming pool, river, tap.

Suggest a good way to record their results is in a table properly

Pupils to write up according to teacher preference and class ability.

Module : Water

Topic : Cleaning up water

Syllabus objectives : 1,2,4,6,7,8

Number of lessons : 1-2

Apparatus : muddy water, sieves, peas, rice, sand, filter paper

Teachers notes : Lesson outcomes 1. filtering will suspensions from river water

2. understand suspension
3. understand solution
4. understand dissolving
5. water is pure when it is a single substance not mixed with anything else
6. filtering is one way of purifying things

Lesson - Where do we get water from?

if all our water is taken from reservoirs, rivers sea, how do we get it to look tap water? get around to the idea of filtering show with sieves sand and peas how a filter works then demo filter paper and funnel

Practical - " to see if filtering cleans up river water, pool water and possibly salt water"

in write up concentrate on drawing a good diagram

conclude by saying you cannot remove blue colour from swimming pool water by filtering but you can remove mud from river water and discuss reasons why, see lesson outcomes

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